Application Note (Syllabus)
GFK-3167A
April 2020

PACMotion VFD

Application Note (Syllabus)

EMERSON

Contents

Revision History

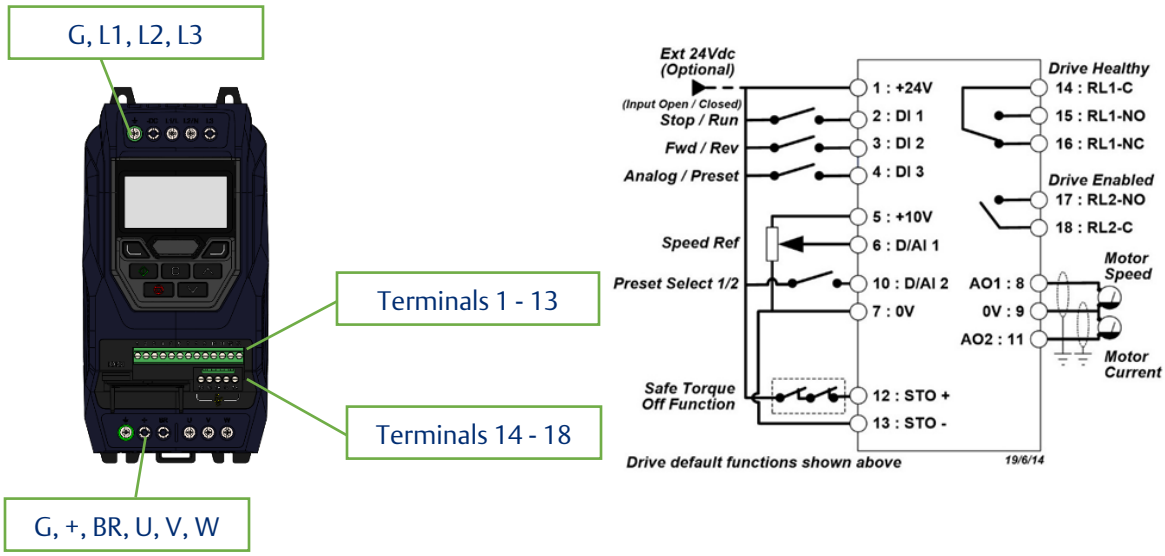
Revision	Date	Description
A	April 2020	Initial Release

Introduction VFD Basic Setup

Basic overview for setup and operation of the PACMotion VFD.

Signal Wiring Example

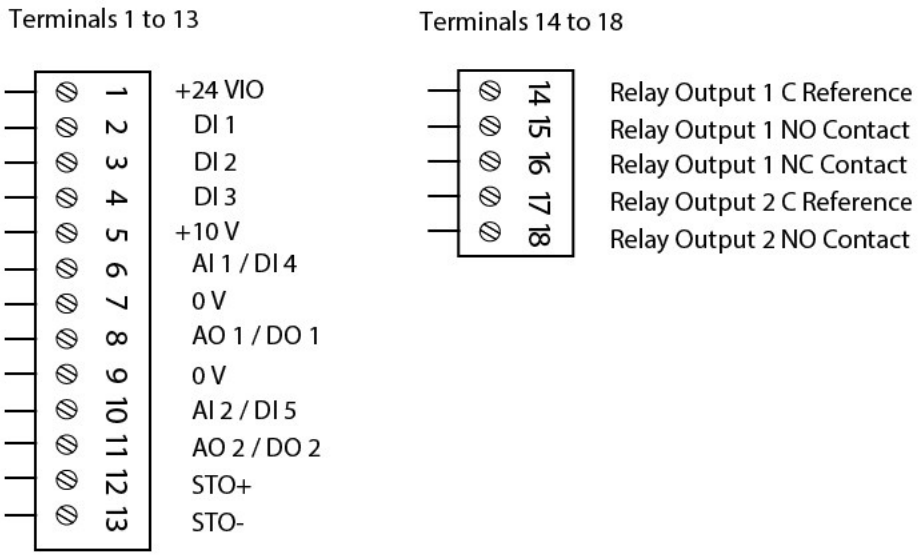
Figure 1: Signal Wiring Example



IO Configuration

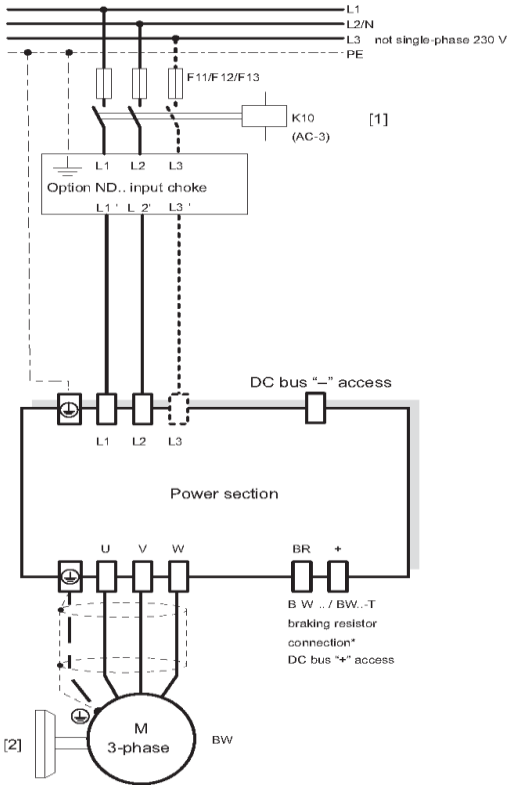
Default configuration for I/O given here. Refer to GFK-3111 and GFK-3112 for details

Figure 2: IO Configuration (Pinout)



Power Wiring Example

Figure 3: Power wiring and Group 1 Parameters Example (VFD/Motor Setup)



P1-01	Maximum Frequency (Speed)	P1-02 to 5 * P1-09 (Max 500Hz)
P1-02	Minimum Frequency (Speed)	0.0 to P1-01 (Hz)
P1-03	Acceleration Time	0 to 600 Seconds
P1-04	Deceleration Time	0 to 600 Seconds
P1-05	Stop Mode	0 : Ramp to Stop 1 : Coast to Stop
P1-06	Energy Optimiser	0: Disable 1: Enable
P1-07	Motor Rated Voltage	Enter the values from the motor rating plate
P1-08	Motor Rated Current	
P1-09	Motor Rated Frequency	
P1-10	Motor Rated Speed	Optional – Set values to RPM
P1-11	V/F Voltage Boost	Drive Dependent
P1-12	Control Source	0 : Terminals 1 : Keypad (Fwd Only) 2 : Keypad (Fwd / Rev)
P1-13	Digital Input Function	See User Guide
P1-14	Parameter Access Code	Set to 101 for access
For further information, refer to the product user guide		

Related Documentation

For more details on wiring and setup refer to documents:

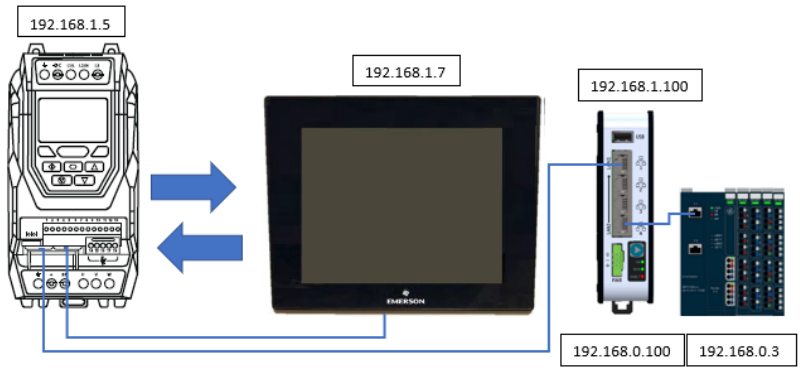
- GFK-3111 PACMotion VFD AC Variable Speed Drive User Guide
- GFK-3112 PACMotion VFD AC Variable Speed Drive Advanced User Guide.

PACMotion VFD Syllabus

A collection of technical Application Notes and Data

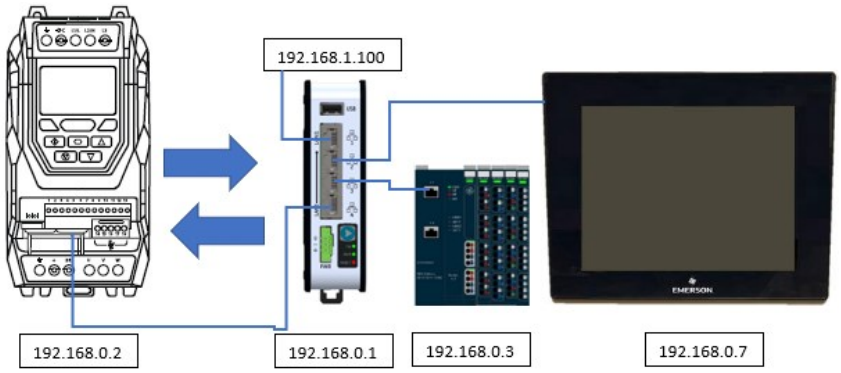
NOTE 1: Modbus/TCP Ethernet Demo (Demo Case with Modbus/TCP Option Card)

Figure 4: CPE100 TO VFD VIA MODBUS/TCP OPTION MODULE WITH QUICKPANEL



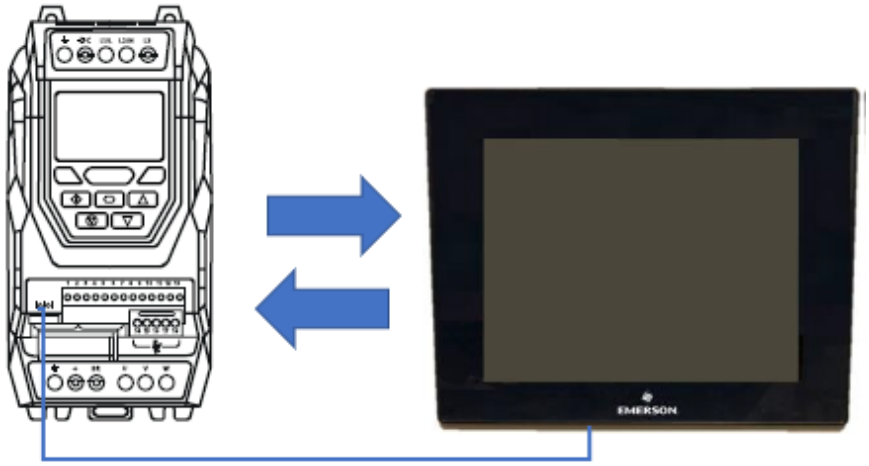
Note 2: PROFINET Demo (Demo Case with PROFINET Option Card

Figure 5: CPE100 TO VFD VIA PROFINET OPTION MODULE WITH QUICKPANEL



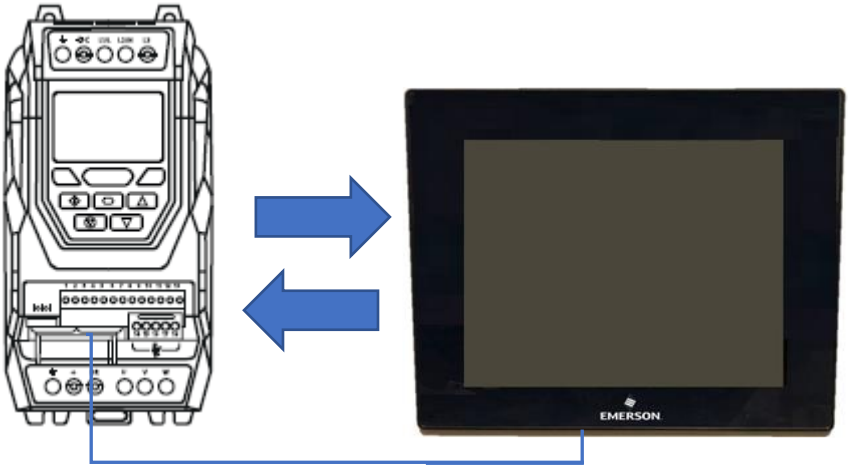
NOTE 3: Modbus RTU Serial Demo (RS-485 2-wire) and Modbus/TCP Demo

Figure 6: Quickpanel Plus or pc w/PME simulator to VFD Built-in Serial Port



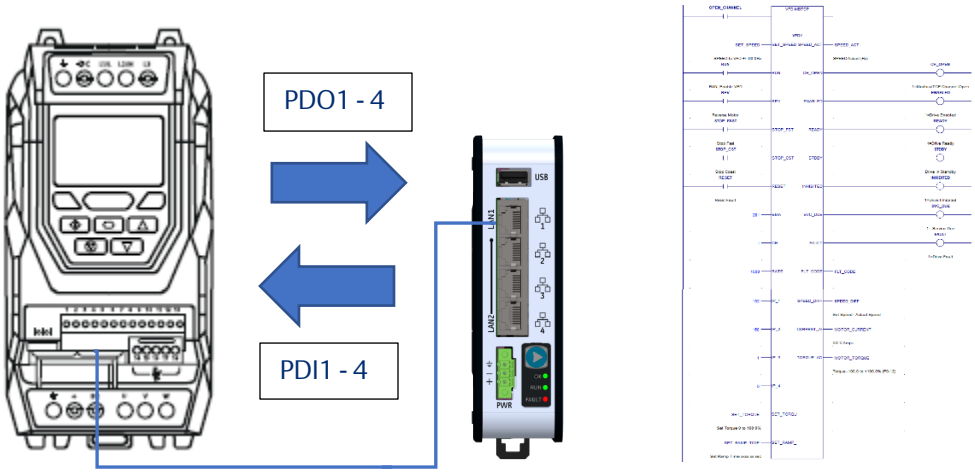
NOTE 4: Modbus/TCP Ethernet Demo

Figure 7: Quickpanel Plus or pc w/PME simulator to VFD Modbus/TCP Option Module



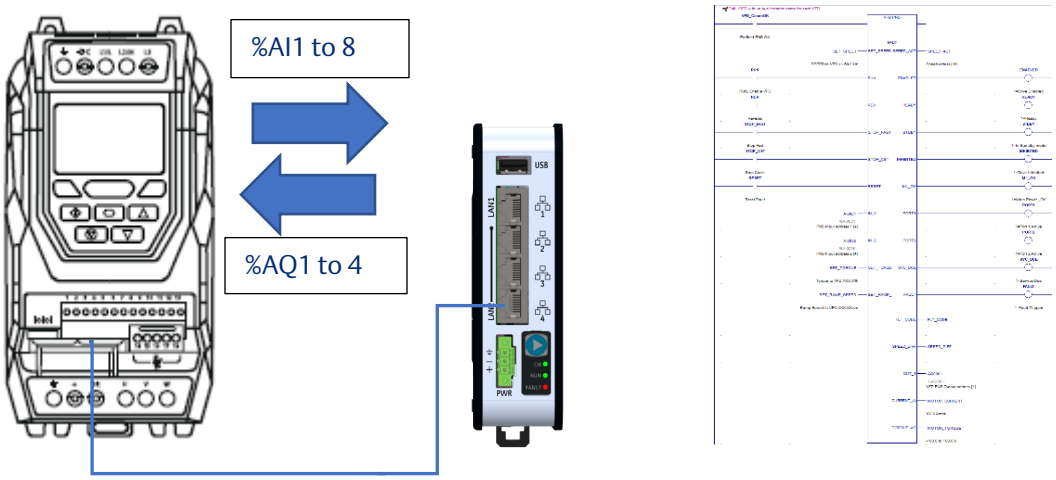
NOTE 5: Modbus/TCP User Defined Function Block Examples

Figure 8: CPE100 to VFD Modbus/TCP Option Module



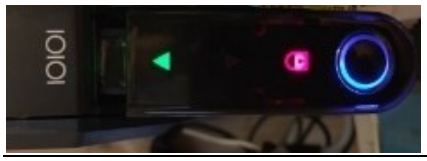
NOTE 6: PROFINET User Defined Function Block Examples

Figure 9: CPE100 to VFD PROFINET Option Module



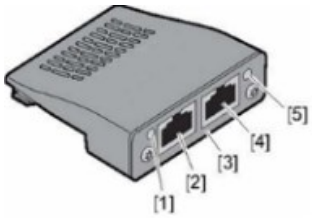
NOTE 7: Using Bluetooth USB or Serial Cable to PACMotion with VFD Suite:

Figure 10: Bluetooth BLE USB Stick



NOTE 8: PACMotion Fieldbus Option Modules and Setup

Figure 11: Fieldbus Option Module



NOTE 9: PACMotion VFD Fieldbus PDI/PDO Data Map and Addressing

Figure 12: PACMOTION VFD FIELDBUS PDI/PDO DATA MAP AND ADDRESSING

Modbus/TCP Addr	Byte Length	R/W	Description	Parameter / Variable Definition
400001	8	W	PDI1 Drive Control	Process Data Input
400002		W	PDI2 FB Speed ref.	Process Data Input
400003		W	PDI3 Torque Ref.	Process Data Input
400004		W	PDI4 Bus Ramp Ctrl.	Process Data Input
300001	8	R	PDO1 Drive Status	Process Data Output
300002			PDO2 Frequency	Process Data Output
300003			PDO3 Output Current	Process Data Output
300004			PDO4 Output torque	Process Data Output

%AI00001	2	R	PDO1	Drive Status Word (Fixed)	Bit 0 : 0 = Drive Disabled (Stopped), 1 = Drive Enabled (Running). Bit 1 : 0 = Drive Healthy, 1 = Drive Tripped. Bit 2 : No Function. Bit 3 : 0 = Drive Ready (STO Input Closed), 1 = Drive Inhibit (STO Input Open). Bit 4 : Maintenance Time Not Reached, 1 = Maintenance Time Reached. Bit 5 : 0 = Not In Standby (Sleep), 1 = Standby (Sleep) mode active. Bit 6 : 0 = Drive Not Ready, 1 = Drive Ready (Mains Power applied, No Inhibit, No Trip, Enable Input Present). Bit 7 : No Function. The Upper Byte will contain the relevant fault number in the event of a drive trip.
%AI00002	2	R	PDO2	Output Frequency (Fixed)	Output frequency of the drive to one decimal place, e.g.123 = 12.3 Hz.
%AI00003	2	R	PDO3	Output Current (or user selected value in P5-12)	Output current of the drive to one decimal place, e.g.105 = 10.5 Amps.
%AI00004	2	R	PDO4	Output Torque (or user selected value in P5-08)	Motor output torque level to one decimal place, e.g. 474 = 47.4 %.
%AI00005	2	R	PDO5		
%AI00005 - bit 1				Module OK (drive healthy-no trip)	
%AI00005 - bit 2				Fault Present (drive tripped)	
%AI00005 - bit 3				Port 1 link up	
%AI00005 - bit 4				Port 2 link up	
%AI00005 - bit 9				Mains power OK (ML = Mains loss indication)	
%AI00005 - bit 10				24 V backup (external 24 V mode)	
%AI00005 - bit 11				MRP enabled (fixed as 1)	
%AI00005 - bit 12				MRP role (fixed as 0)	
%AI00005 - bit 16				Drive ready to run	
%AI00006	2	R	PDO6		
%AI00006 - bit 1				Drive enabled (Running)	
%AI00006 - bit 2				STO status	
%AI00006 - bit 3				Service due	
%AI00007	2	R	PDO7		
%AI00008	2	R	PDO8		
%AQ00001	2	W	PDI1	Drive Command Control Word	Bit 0 : Run/Stop command. Set to 1 to enable the drive. Set to 0 to stop the drive. Bit 1 : Fast stop request. Set to 1 to enable drive to stop with 2nd deceleration ramp. Bit 2 : Reset request. Set to 1 in order to reset any active faults or trips on the drive. This bit must be reset to zero once the fault has been cleared. Bit 3 : Coast stop request. Set to 1 to issue a coast stop command.
%AQ00002	2	W	PDI2	Command Speed Reference	Setpoint must be sent to the drive in Hz to one decimal place, e.g. 500 = 50.0Hz.
%AQ00003	2	W	PDI3	Command Torque Reference	Setpoint must be sent to the drive in % to one decimal place, e.g. 1000 = 100.0%.
%AQ00004	2	W	PDI4	Command Ramp Times	This register specifies the drive acceleration and deceleration ramp times used when Fieldbus Ramp Control is selected (P5-08 = 1) irrespective of the setting of P1-12. The input data range is from 0 to 60000 (0.00s to 600.00s).

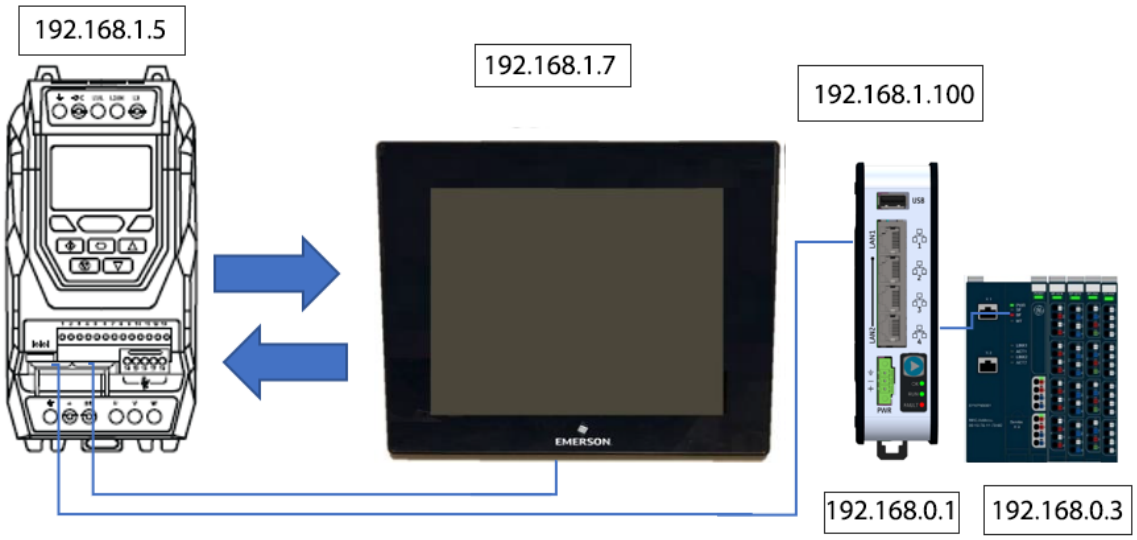
NOTE 10: PACMotion VFD Complete PDI/PDO Data Map and Addressing

PACMotion_VFD_Address_Map.xlsx - Excel

NOTE 11: PACMotion VFD Demo Case Details

Modbus/TCP Ethernet Demo (Note 1)

Figure 13: Modbus/TCP Ethernet Configuration



This Demo uses the CPE100 as the Initiating device for Modbus/TCP communications.

VFD Parameters

1. Set to the following VFD parameter values:

Parameter	Value and Description
P1-12 P1-14 P5-05	4 (Fieldbus) 201 (Extended Menu Access) 0.0 (Disable communication loss timeout)

QuickPanel Plus Ethernet Settings

2. Set the following IP Address/Mask:

   IP address = 192.168.1.7

   Subnet mask = 255.255.255.0

VFD Modbus/TCP Option Module settings

3. Use a DHCP server or the HMS IPConfig software to set the IP address of the Modbus/TCP module. Use the following settings:

   IP address = 192.168.1.5
   Subnet mask = 255.255.255.0

Starting the system

4. As shown in the picture above, connect one ethernet port of the VFD Modbus/TCP option module to the QuickPanel and connect the other ethernet port of the VFD Modbus/TCP option module to the top port of CPE100.

5. Power up the devices.

6. Using a laptop PC with PAC Machine Edition, load in the PAC Machine Edition project:

   "VFD_DEMOCASE_MBTCP_Vx" and Download/Run the CPE100 and QuickPanel targets. This will use the CPE100 as a Modbus/TCP Master.

7. The QuickPanel Screen should show live PDI/PDO Data. Information on this data is given below.

Modbus/TCP Process Data Exchange

The mapping of Process Data Output/Input to Modbus/TCP Registers is shown below.

Process Data Word	Modbus/TCP Register[1] *
PDO1	300001
PDO2	300002
PDO3	300003
PDO4	300004
PDI1	400001
PDI2	400002
PDI3	400003
PDI4	400004

Modbus/TCP Connection Timeout

The VFD Modbus/TCP interface allows the user to set the "Communication Loss Timeout" and "Communication Loss Action" values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the range is from 0.0 (disable) to 5.0 seconds. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

[1] Modbus Clients may address the first Modbus register as register 300001/400001. This assumes an address offset starting at 1. For Clients that use zero based addressing just subtract 1.

Drive Parameter Access

The Modbus/TCP Interface allows the user to read/write the drive parameters. To perform this function, the user can directly access the parameter. Simply add the parameter number to the Modbus offset of 400000.

For example:

Read parameter P1-01 (Maximum Frequency), perform the following

Read Modbus/TCP Address 400101 value (scaling in 0.1 Hz).

Write parameter P1-01 (Maximum Frequency) = 60.0 Hz, perform the following

Write to Modbus/TCP Address 400101 value = 600 (scaling in 0.1 Hz)

Supporting Files

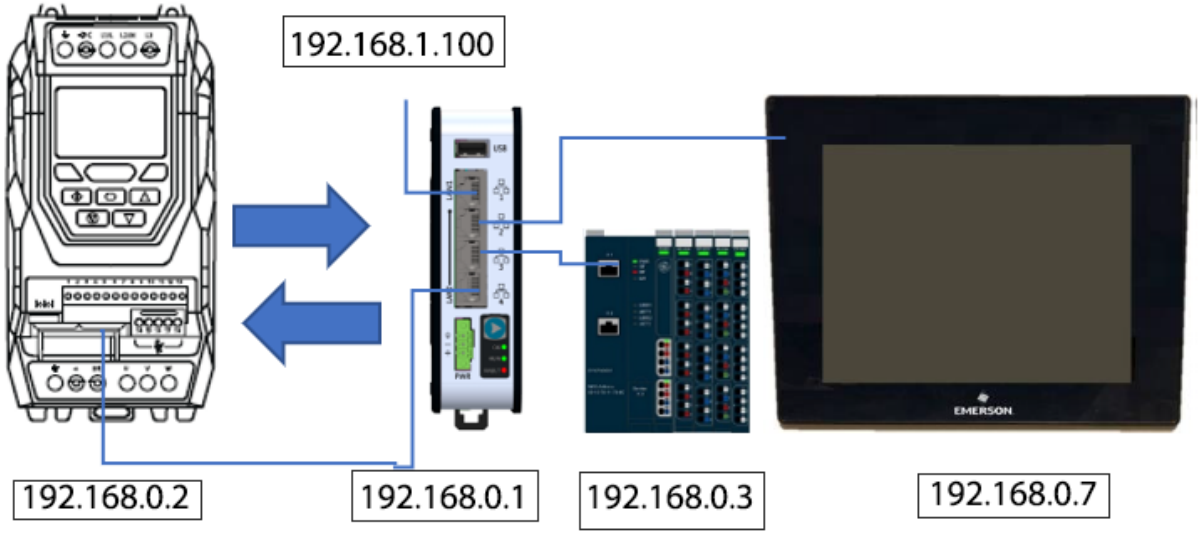
Figure 14: VFD Demo Case file

VFD_DEMOCASE_MBTCP_V2.zip

Right-click the icon to Copy the file.

PROFINET Controller Demo (Note 2)

Figure 15: CPE100 (PROFINET Controller) to VFD PROFINET Slave Demo



VFD Settings

1. VFD Parameters must be set to the following values:

   For help on changing parameters Refer to Manual GFK-3111.

Parameter	Value and Description
P1-12	4 (Fieldbus)
P1-14	201 (Extended parameter description)
P5-05	0.0 (Disable communication loss timeout)

VFD I/O Signals

Digital

By default, the VFD signals Digital Input 1 (DI1) and Safe Torque Off (STO) must be energized to allow the VFD to Run. These signals are wired to and powered by the demo RSTi-EP outputs. The outputs are set automatically when a certain screen is used on the QuickPanel.

Analog

The Analog I/O of the RSTi-EP module allow various analog signals to control/monitor the VFD.

The following is a default map of the I/O points used in the Demo unit:

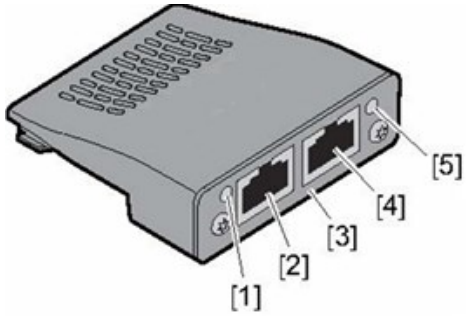
CPE100	PACMotion VFD	Signal
%Q00001	DI1	Enable Drive
%Q00002	DI2	Reverse
%Q00003	DI3	Set Point 1
%I00001	DI1	Drive Enabled
%AQ00001	AI1	Speed (reference)
%AI00001	AO1	Speed (actual)
24VDC	STO +	Safe Torque +
0VDC	STO -	Safe Torque -

Option Module Details

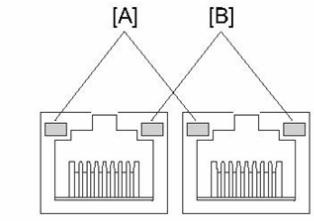
1. To use PROFINET with the VFD a PROFINET Option Module must be installed.

The PROFINET option card permits the PACMotion VFD Drive to connect to a PROFINET network.

IC866-OC-P PROFINET Option Card for VFD



PROFINET Option Card



RJ45 Connectors & Network Activity LEDs, PROFINET Option Card

[1]	LED: NS	[A]	LED: Activity
[2]	RJ45: P1	[B]	LED: Link
[3]	Labeling: PROFINET I/O		
[4]	RJ45: P2		
[5]	LED: MS		

Bus Specific Technical Data

Baud rate	10/100 Mbaud in full duplex mode
Connection technology	2 × RJ45

Hardware Insertion and Removal

Remove power from the VFD. Using a T9 driver bit, backout the 2 option module screws approximately 4 or 5 turns each. This should allow the locking tabs to retract to a flat position. Insert the module into the VFD fieldbus option module cage and gently press it into place. Secure the T9 screws until they touch the module. This will engage the locking tabs to hold it in place. Do not over tighten.

(Note: If the T9 screws are not backed out first the module will not insert or remove properly.)

To remove the option module remove power from the VFD. Using a T9 driver bit backout the option module 2 screws approximately 4 or 5 turns each. Gently pull the module out by pulling on the screws.

PROFINET Slave Module Settings

1. **With the PROFINET option module installed power up the VFD.**

Using the PROFINET DCP tool, which is part of the PAC Machine Edition Utilities, set the following VFD PROFINET Slave values example:

Device Name	IP Address
vfd-1	192.168.0.2

2. **The QuickPanel Plus Ethernet Settings must be set to the following values:**

   IP address = 192.168.0.7
   Subnet mask = 255.255.255.0

Starting the system

3. Connect the VFD PROFINET option module to an available PROFINET port on the CPE100 (the lower 3 ports) and the QuickPanel to the top ethernet port on the CPE100 and power up the devices.

   This is done inside the official PACMotion VFD Demo case.

4. **Using a laptop PC with PAC Machine Edition, load in the PAC Machine Edition project:** "VFD_DEMOCASE_PN_Vx" and Download/Run the QuickPanel and CPE100 targets through the front panel ports labeled "PROFINET/HMI" and "PLC".

Supporting Files

Figure 16: VFD Demo Case file

VFD_DEMOCASE_PN_V6.zip

Right-click the icon to Copy the file.

PROFINET Process Data Exchange

The mapping of Process Data Output/Input to Modbus RTU Registers is shown below.

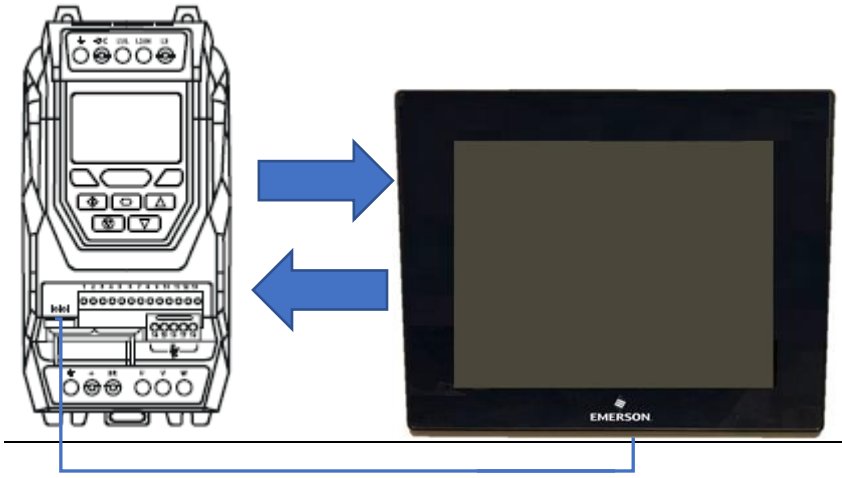
Process Data Word	Typical CPE100 Address
PDO1	%AI00001
PDO2	%AI00002
PDO3	%AI00003
PDO4	%AI00004
PDI1	%AQ00001
PDI2	%AQ00002
PDI3	%AQ00003
PDI4	%AQ00004

Fieldbus Connection Timeout

The VFD interface allows the user to set the “Communication Loss Timeout” and “Communication Loss Action” values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the range is from 0.0 (disable) to 5.0 seconds. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

MODBUS RTU SERIAL DEMO (NOTE 3)

Figure 17: Quickpanel Plus or PC w/PME simulator to VFD Built in Serial Port



1. **VFD Parameters must be set to the following values:**

Parameter	Value and Description
P1-12	4 (Fieldbus)
P1-14	201 (Extended parameter description)
P5-01	1 (Fieldbus address)
P5-03	1 (Modbus RTU Baud rate 19.2Kbps)
P5-04	0 (Modbus data format, no parity, 1 stop bit)
P5-05	0.0 (Disable communication loss timeout)
P5-16	0 (Extended Modbus drive address)

2. **QuickPanel Plus with COM2 wiring (the 7 inch QuickPanel Plus does not have a COM2):**

   Note: To use a 7 inch QuickPanel Plus you would have to add a USB to RS-485/2-wire serial port.

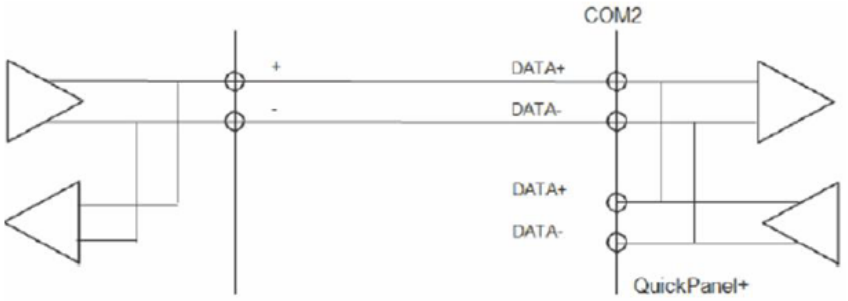
3. Set the QuickPanel Plus DIP switches for RS-485 2 wire operation.

Figure 18: RS-485 2 Wire Operation

DIP Switch Settings COM2 for RS-485

DIPSW	Bit	ON/OFF	DIPSW	Bit	ON/OFF
SW2	1	OFF	SW4	1	ON
	2	OFF		2	ON
	3	ON		3	ON
	4	OFF		4	ON
	5	ON		5	ON
	6	ON		6	ON
	7	OFF		7	OFF
	8	ON		8	OFF
SW3	1	OFF	SW5	1	OFF
	2	ON		2	OFF
	3	OFF		3	OFF
	4	ON		4	OFF

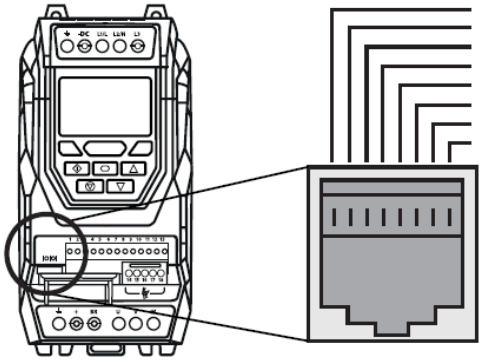
Figure 78: Example of Half-Duplex (RS–485 Mode) Connection



4. VFD to QuickPanel COM2 wiring Serial Cables

Make a serial cable with the following connections. Be sure to jumper the TXD+/RXD+ and TXD-/RXD- on the QuickPanel for RS-485 two wire operation.

Figure 19: QuickPanel COM2 Port



1	CAN-
2	CAN+
3	0 Volts
4	Optibus / Remote Keypad / PC Connection
5	Optibus / Remote Keypad / PC Connection +
6	+24 Volt
7	-RS485 (Modbus RTU)
8	+RS485 (Modbus RTU)

Warning:
This is not an Ethernet connection. Do not connect directly to an Ethernet port.

Warning:
When using Modbus RTU or CANopen, ensure that the 0V signal (T3) is also used to avoid comms errors and potentially damaging common mode voltages.

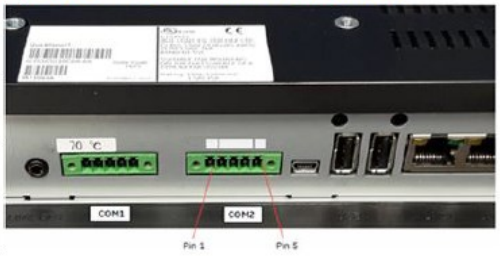
Pin #	Signal Name		
	RS–232C	RS-485 (Full-duplex[2])	RS-485 (Half-duplex)
1	TXD	TXD+	DATA+[3]
2	RXD	TXD-	DATA-[3]
3	RTS	RXD+	DATA+[3]
4	CTS	RXD-	DATA-[3]
5	SGND	SG	SG

Serial Port COM2 Details

Interface: RS-232C/485 (default is RS-485 Half-duplex)

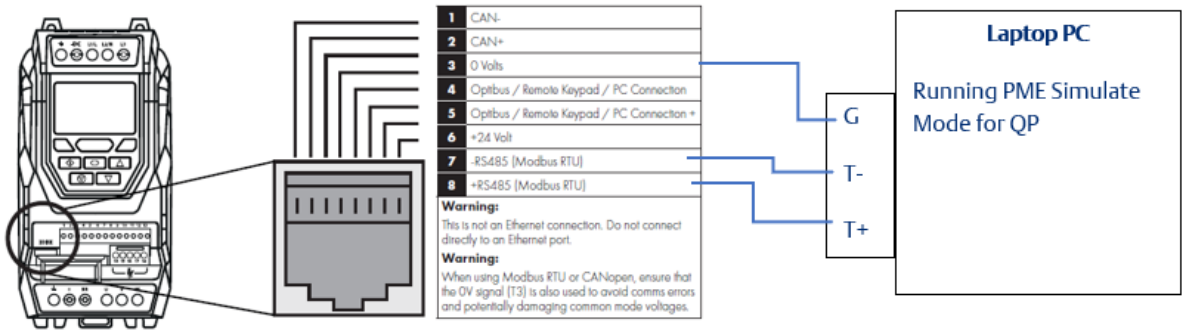
Pin #	Signal Name			Pin-Out
	RS–232C	RS-485 (Full-duplex[2])	RS-485 (Half-duplex)	
1	TXD	TXD+	DATA+[3]	
2	RXD	TXD-	DATA-[3]	
3	RTS	RXD+	DATA+[3]	
4	CTS	RXD-	DATA-[3]	
5	SGND	SG	SG	

Figure 76: Serial Port COM2 Pin-Out IC755CxSxxCDx



5. VFD to Laptop with RS-485 two wiring with a device such as USB Gearmo Model USA:-482422

Figure 20: Serial connections PC to VFD



6. Connect the VFD to the Modbus Device and power up the devices.

7. Load in the example PAC Machine Edition project:

"VFD_Modbus_RTU_QPPlus12_VerX" and Download/Run the QuickPanel or the Laptop in Simulate mode.

8. Set the required VFD terminal discrete signals properly to allow VFD operation.

DI1 = ON (Enabled) and STO = ON (Safe Torque ON)

Supporting Files

Figure19: Modbus RTU Serial Demo file

VFD_Modbus_RTU_QPPlus12_Ver2.zip

Right-click the icon to Copy the file.

Modbus RTU Process Data Exchange

The mapping of Process Data Output/Input to Modbus RTU Registers is shown below.

Process Data Word	Modbus RTU Register[2]
PDO1	300001
PDO2	300002
PDO3	300003
PDO4	300004
PDI1	400001
PDI2	400002
PDI3	400003
PDI4	400004

Modbus RTU Connection Timeout

The VFD Modbus RTU interface allows the user to set the "Communication Loss Timeout" and "Communication Loss Action" values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the valid range is from 0.0 (disable) to 5.0 seconds. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

Drive Parameter Access

The Modbus RTU Interface allows the user to read/write the drive parameters. To perform this function, the user can directly access the parameter. Simply add the parameter number to the Modbus offset of 400000.

For example:

Read parameter P1-01 (Maximum Frequency), perform the following

Read Modbus RTU Register 400101 value (scaling in 0.1 Hz).

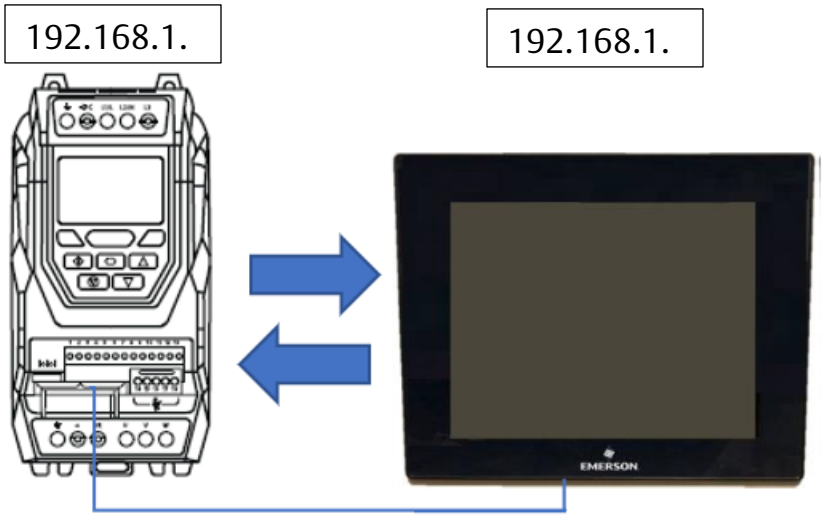
Write parameter P1-01 (Maximum Frequency) = 60.0 Hz, perform the following

Write to Modbus RTU Register 400101 value = 600 (scaling in 0.1 Hz)

[2] Modbus Clients may address the first Modbus register as register 300001/400001. This assumes an address offset starting at 1. For Clients that use zero based addressing just subtract 1.

MODBUS/TCP DEMO (NOTE 4)

Figure 20: QUICKPANEL PLUS OR PC W/PME SIMULATOR TO VFD MODBUS/TCP OPTION MODULE



This Demo uses the Quick Panel Plus as the Initiating device for Modbus/TCP communications.

1. **VFD Parameters must be set to the following values:**

Parameter	Value and Description
P1-12	4 (Fieldbus)
P1-14	201 (Extended parameter description)
P5-01	1 (Fieldbus address)
P5-05	0.0 (Disable communication loss timeout)

2. **QuickPanel Plus Ethernet Settings**

Set the following IP Address/Mask:

IP address = 192.168.1.7

Subnet mask = 255.255.255.0

3. **VFD Modbus/TCP Option Module settings**

Use a DHCP server or the HMS IPConfig software to set the IP address of the Modbus/TCP module. Use the following settings:

IP address = 192.168.1.5

Subnet mask = 255.255.255.0

4. **Connect the VFD to the Modbus/TCP Device and power up the devices.**

5. **Load in the example PAC Machine Edition project:**

"VFD_ModbusTCP_QPPlus12_VerX" and Download/Run the QuickPanel or the Laptop in Simulate mode.

6. **Set the required VFD terminal discrete signals properly to allow VFD operation.**

DI1 = ON (Enabled) and STO = ON (Safe Torque ON)

Supporting Files

Figure 21: VFD Modbus TCP

VFD_ModbusTCP_QPPlus12_Ver2.zip

Right-click the icon to Copy the file.

Modbus/TCP Process Data Exchange

The mapping of Process Data Output/Input to Modbus/TCP Registers is shown below.

Process Data Word	Modbus RTU Register[3]
PDO1	300001
PDO2	300002
PDO3	300003
PDO4	300004
PDI1	400001
PDI2	400002
PDI3	400003
PDI4	400004

Modbus/TCP Connection Timeout

The VFD Fieldbus interface allows the user to set the "Communication Loss Timeout" and "Communication Loss Action" values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the valid range is from 0.0 (disable) to 5.0 seconds. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

[3] Modbus/TCP Clients may address the first Modbus/TCP register as register 300001/400001. This assumes an address offset starting at 1. For Clients that use zero based addressing just subtract 1.

Drive Parameter Access

The Modbus/TCP Interface allows the user to read/write the drive parameters. To perform this function, the user can directly access the parameter. Simply add the parameter number to the Modbus/TCP offset of 400000.

For example:

Read parameter P1-01 (Maximum Frequency), perform the following

Read Modbus/TCP Register 400101 value (scaling in 0.1 Hz).

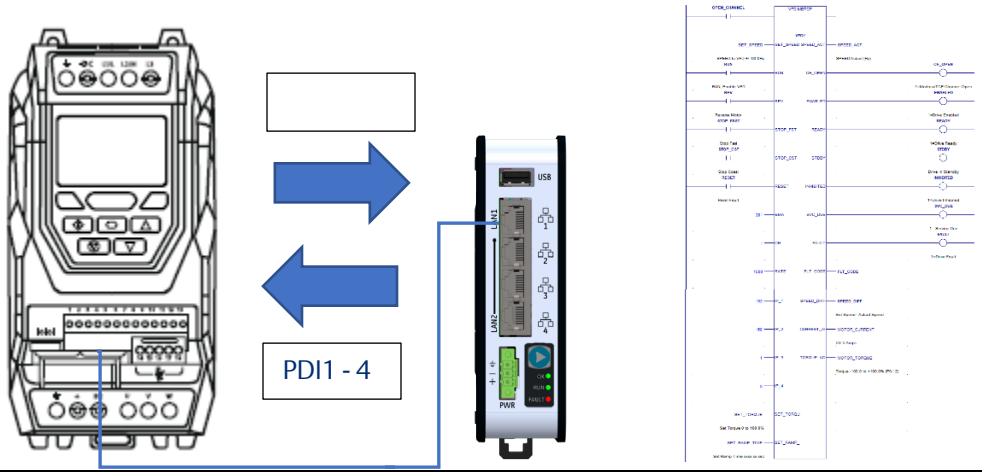
Write parameter P1-01 (Maximum Frequency) = 60.0 Hz, perform the following

Write to Modbus/TCP Register 400101 value = 600 (scaling in 0.1 Hz)

USER DEFINED FUNCTION BLOCK – MODBUS/TCP

(NOTE 5)

Figure 22: For Use with PACMotion VFD Modbus/TCP Option Module



1. **Install the Modbus/TCP Option Module in your VFD.**

   Typical Part number IC866-OC-M.

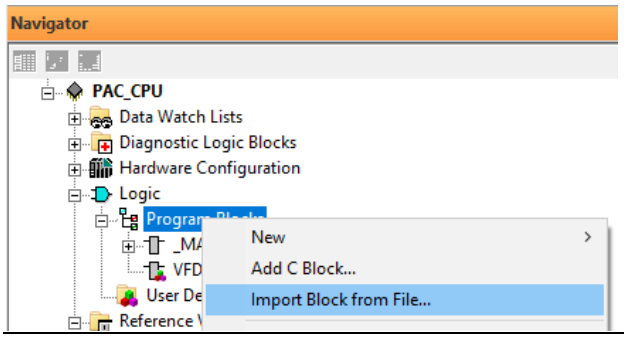
2. **The proper IP addresses must be set for your devices to communicate.**

   CPE100 = 192.168.1.100 (set with Proficy Machine Edition (PME)
   VFD = 192.168.1.5 (set with a DHCP Server or IPCONFIG Tool from Anybus.Com)

3. **Import the UDFB into PME.**

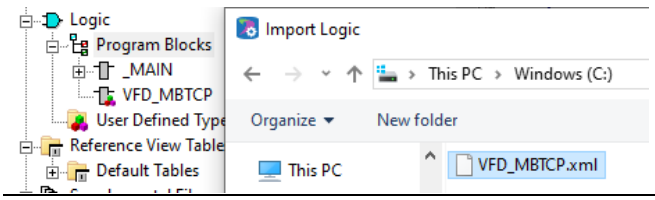
   The UDFB named “VFD_MBTCP” can be added to your PME project with the “Import Drawer” function of the Toolchest, or the “Import Block From File” function of the Navigator Program Blocks. Below is an example of the Navigator Import Block from File:

Figure 23: Import Block from File



Choose the XML file named “VFD_MBTCP.XML”

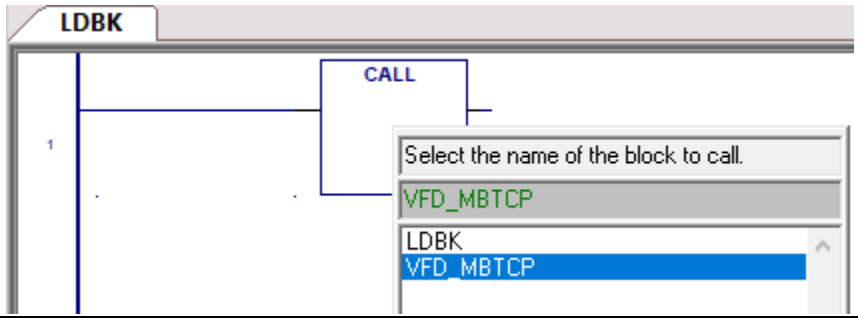
Figure 24: Select the XML File



4. **Using the UDFB in your Logic.**

Insert a CALL statement in your Logic and Double-Click on the CALL and choose the UDFB “VFD_MBTCP”.

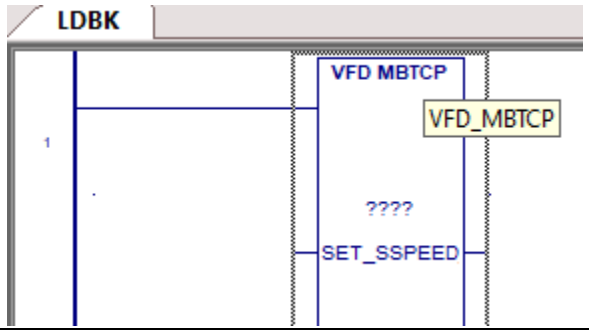
Figure 25: Insert a Call Statement



5. **Assign the UDFB Instance name in your Logic.**

You must assign an Instance name that is unique to the UDFB. Position the cursor on the block and type in the Instance name where the question marks are.

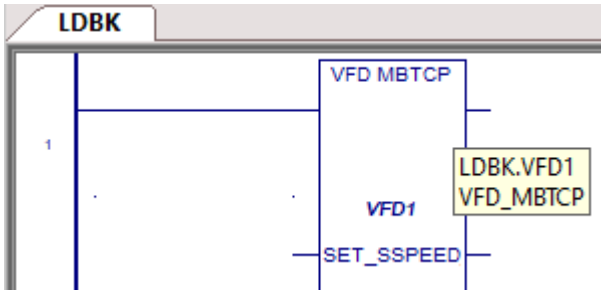
Figure 26: Assign an Instance Name



6. This Instance will have created a Structure with all variables needed for the PNS.

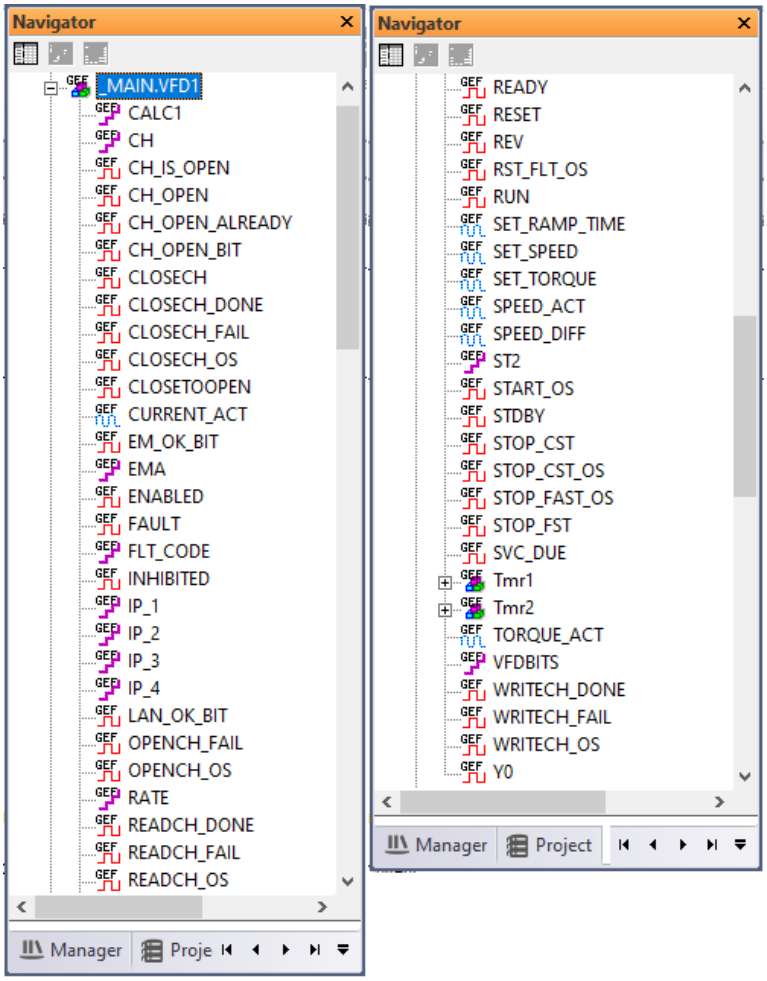
The Instance “VFD1” name is shown as an example below:

Figure 27: Instance Has Been Created



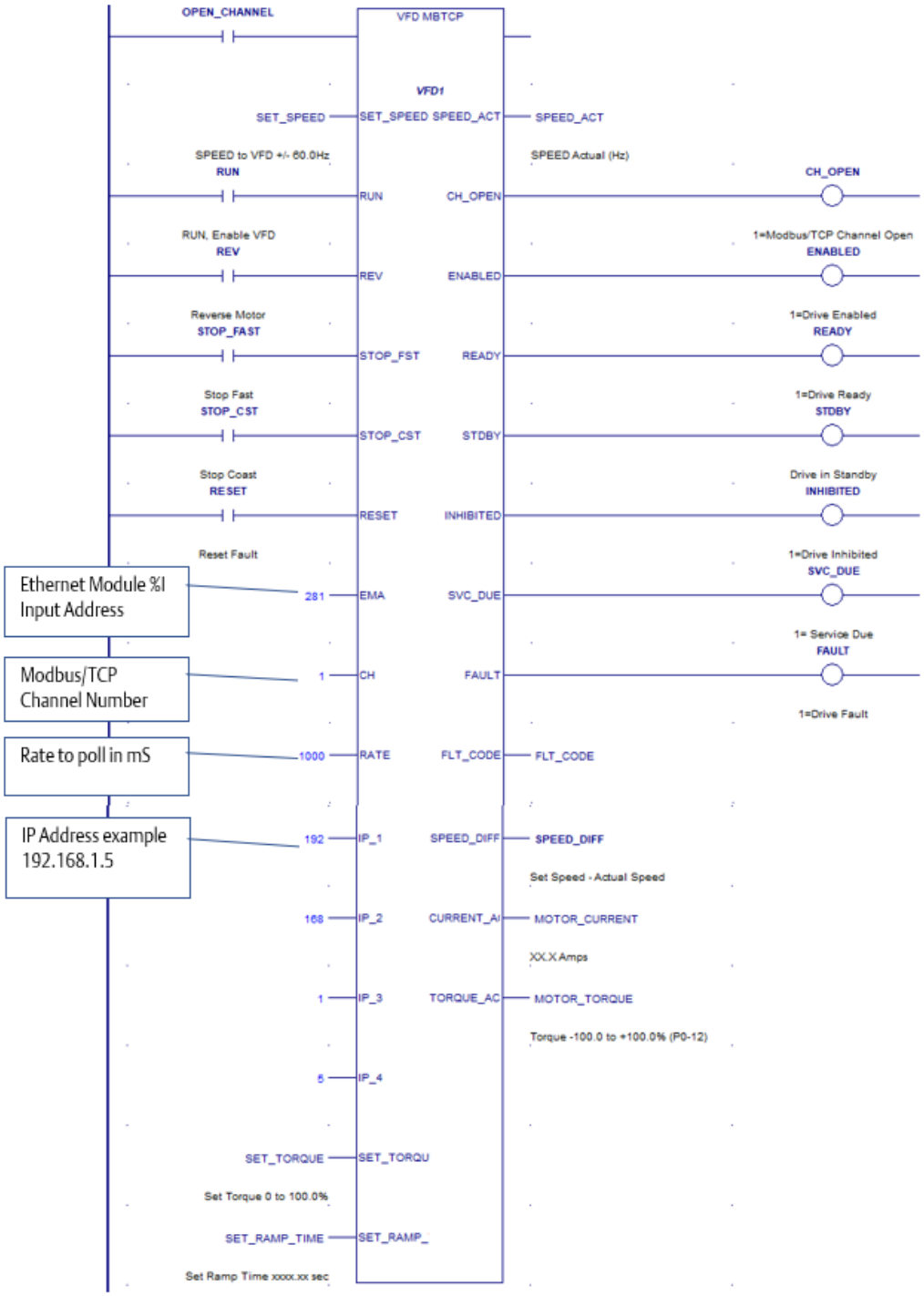
The Structure of points used in the Instance of this UDFB shown below:

Figure 28: Structure of Points used in Instance



7. **Assign input and output node variables.**
   This UDFB is an example of how the Modbus/TCP functions of the VFD can be controlled/monitored. Each Instance of the UDFB must have a different and unique Instance Name (VFD1 below). Various node names are given to reflect the function they represent.

Figure 29: Assign Input and Output Node Variables



8. Starting the system

Be sure to set your VFD Parameter P1-12 to 4 for Fieldbus Control.

Download the project to your PACSystems Controller.

Connect the top Ethernet Port of the CPE100 to the VFD Modbus/TCP option module. Power up the devices and test functionality.

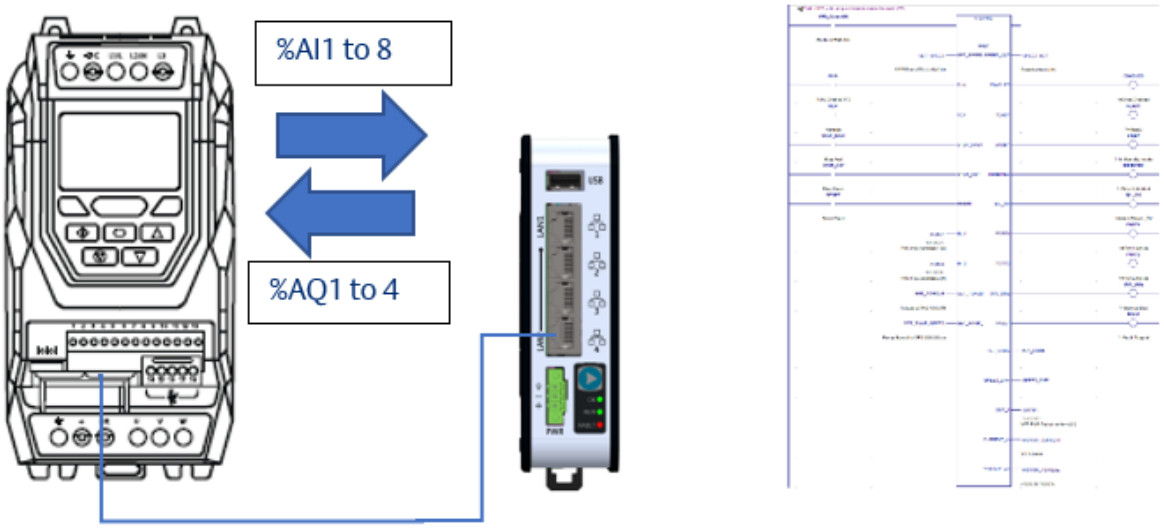
9. Setting Fieldbus Connection Timeout Preferences

The VFD interface allows the user to set the “Communication Loss Timeout” and “Communication Loss Action” values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the range is from 0.0 (disable) to 5.0 seconds. Set these appropriately. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

USER DEFINED FUNCTION BLOCK – PROFINET

(NOTE 6)

Figure 30: For Use with PACMotion VFD PROFINET Option Module



1. **Install the PROFINET Slave Option Module in your VFD.**

   Typical Part number IC866-OC-P.

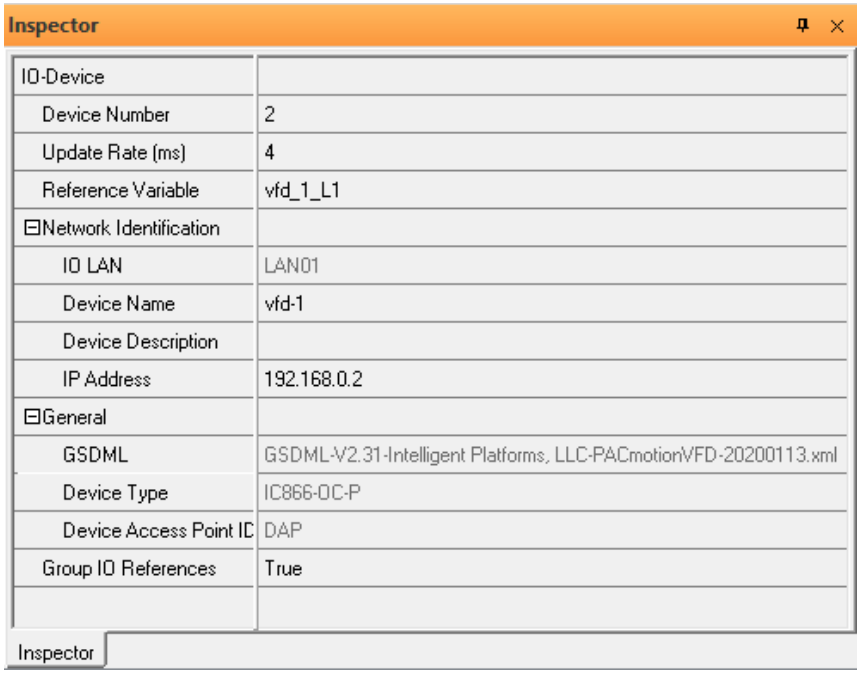
2. **The proper GSDML file for this device must be added to your PROFINET Controller in PAC Machine Edition (PME). The VFD will become a PROFINET Slave (PNS).**

   Typical file name: GSDML-V2.31-Intelligent Platforms, LLC-PACmotionVFD-20200113.xml

3. **The unique PROFINET Name and IP address should be set for each PNS.**

   Be sure your IP address is in the PROFINET Controller (PNC) range and to assign a Reference Variable to each (PNS & PNC) for PNIO_DEV_COMM use later, typical PNS settings are shown below:

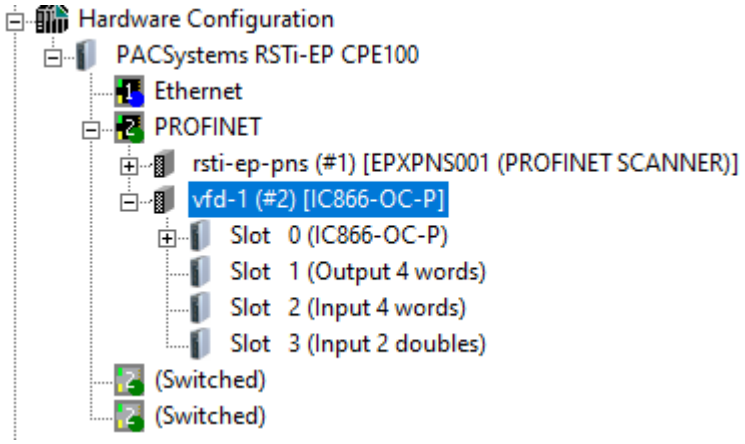
Figure 31: PNS Settings



4. The PNS will have 4 slots autoconfigured:

   Slots 1,2,3 must be addressed. Double-click on the slots and configure them.

Figure 32: Configured Slots

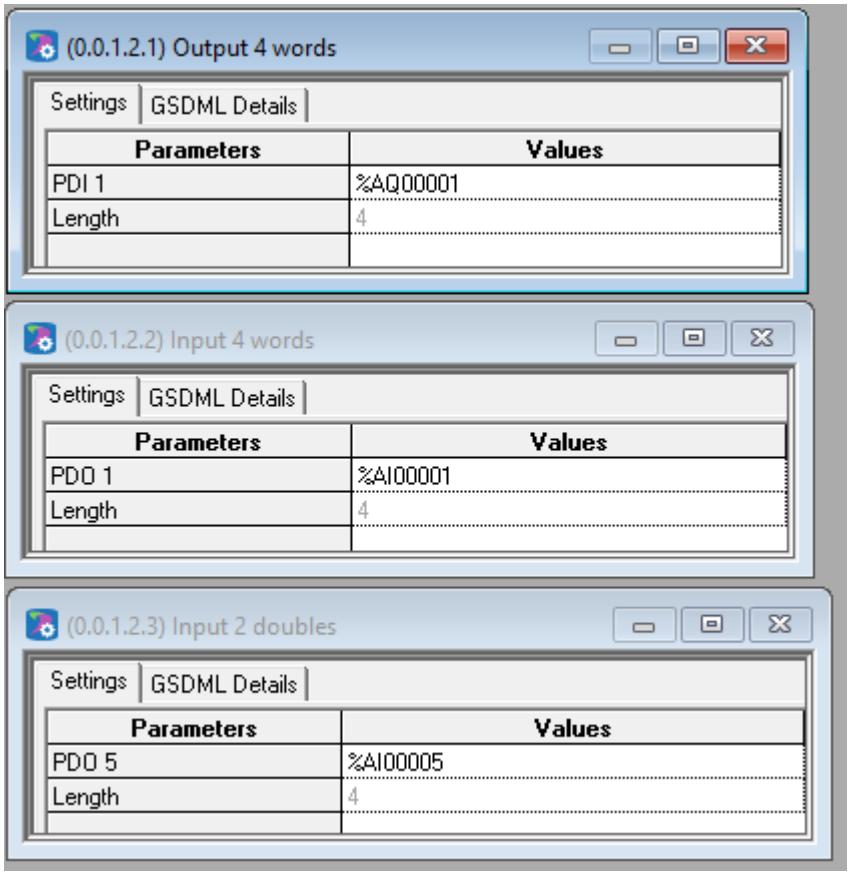


5. PROFINET PNS Configuration in PME:

   3 address ranges must be entered for the PNS with similar values to the example below:

   - %AQ00001 Length 4 Words (slot 1)
   - %AI00001 Length 4 Words (slot 2)
   - %AI00005 Length 4 Words (slot 3)

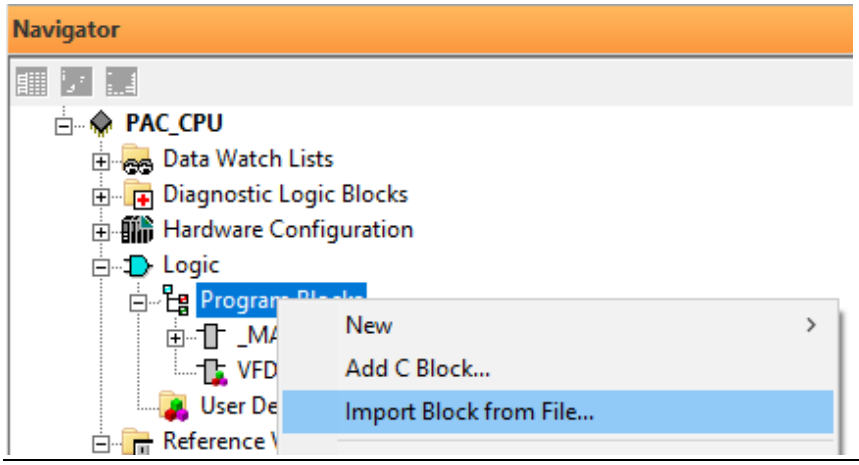
Figure 33: PROFINET PNS Configurations



6. Import the UDFB into PME.

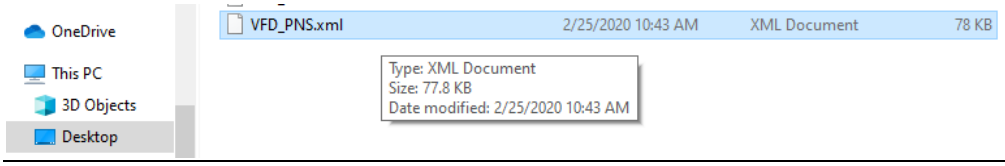
The UDFB named “VFD_PNS” can be added to your PME project with the “Import Drawer” function of the Toolchest, or the “Import Block From File” function of the Navigator Program Blocks. Below is an example of the Navigator Import Block from File:

Figure 34: Import the UDFB into PME



7. Choose the XML file named “VFD_PNS.XML”.

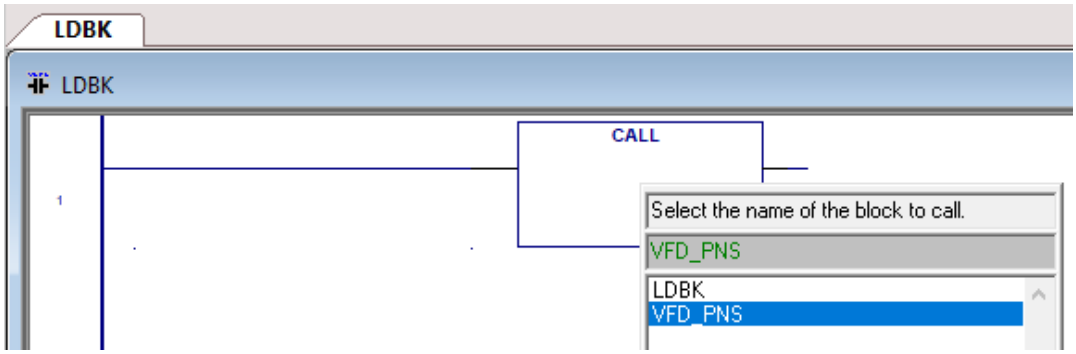
Figure 35: Choose the XML File



8. Using the UDFB in your Logic.

Insert a CALL statement in your Logic and Double-Click on the CALL and choose the UDFB “VFD_PNS”.

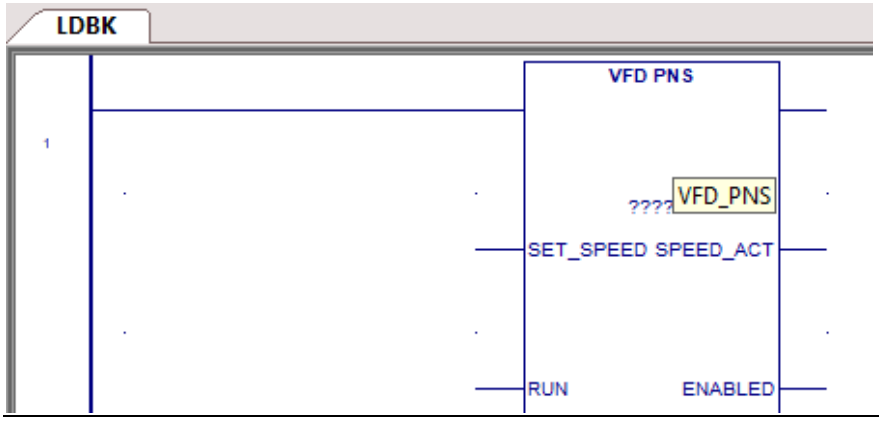
Figure 36: UDFB Logic



9. **Assign the UDFB Instance name in your Logic.**

   You must assign an Instance name that is unique to the UDFB. Position the cursor on the block and type in the Instance name where the question marks are.

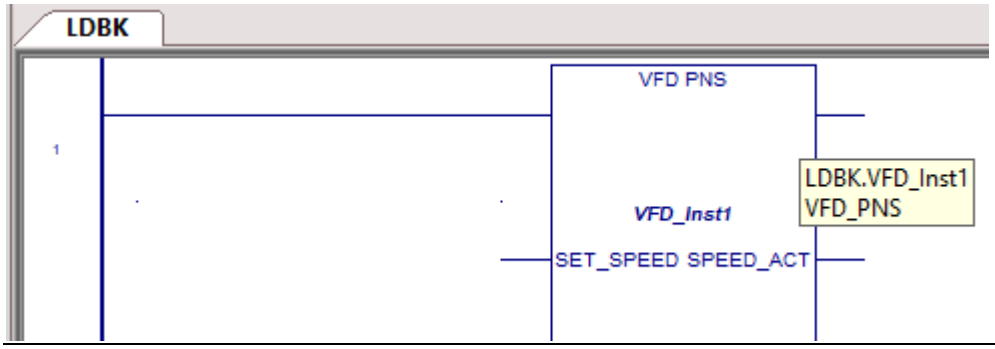
Figure 37: Assigning Instance Name



10. **This Instance will have created a Structure with all variables needed for the PNS.**

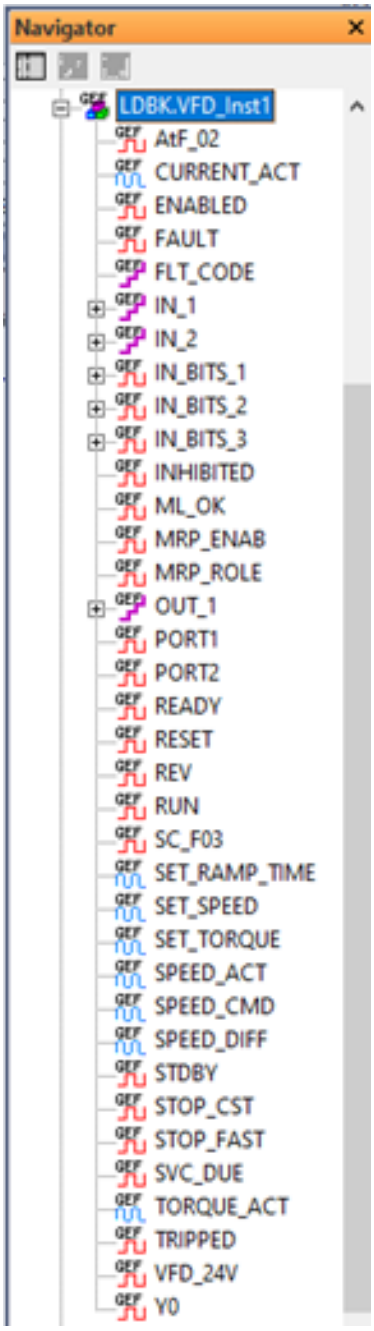
    The Instance "VFD_Inst1" name is shown as an example below:

Figure 38: Instance-Created Structure



11. The Structure of points used in the Instance of this UDFB shown below:

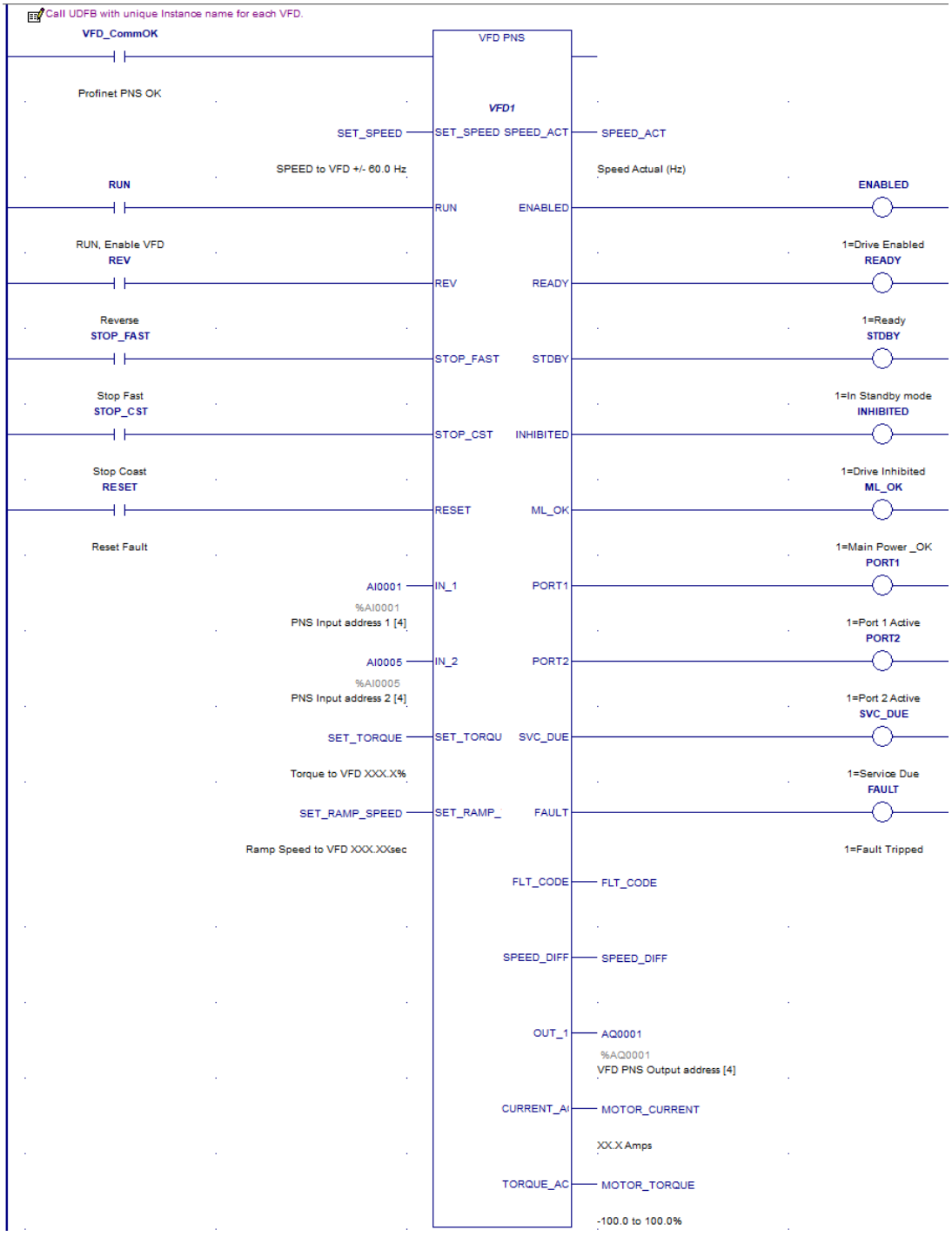
Figure 39: Structure of Points in Instance



12. Assign input and output node variables.

This UDFB is an example of how the PROFINET functions of the VFD can be controlled/monitored. Each Instance of the UDFB must have a different and unique Instance Name (VFD1 below). Various node names are given to reflect the function they represent.

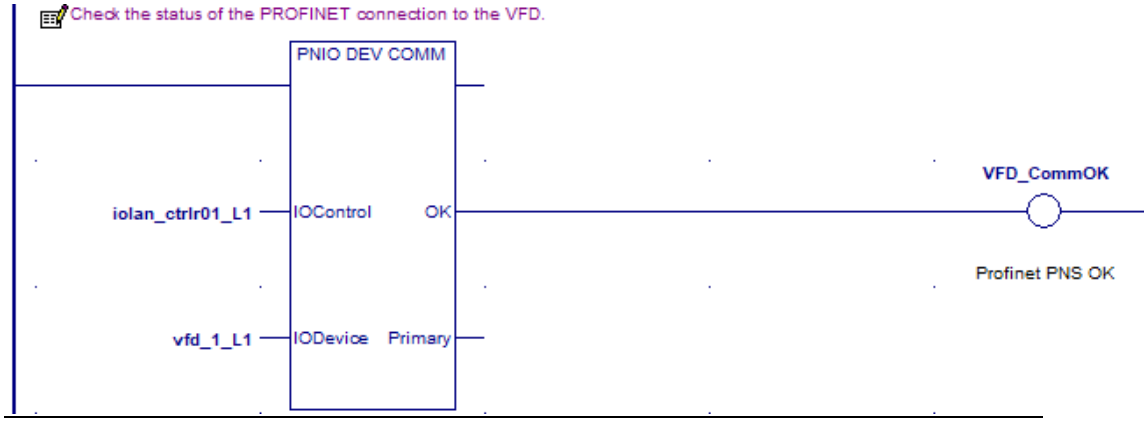
Figure 40: Assign IO Node Variables



13. Starting the system

Be sure to set your VFD Parameter P1-12 to 4 for Fieldbus Control. You may wish to insert a PNIO_DEV_COMM block (similar to below) to assure your PROFINET Controller and PNS are communicating without issue. The Reference Variables names created in step 3 can be used for the PNIO_DEV_COMM. The output of the PNIO_DEV_COMM can be used to power the UDFB.

Figure 41: Check the Status of the PNS Connection



14. Download the project to your PACSystems Controller.

Connect the PROFINET Controller to the VFD PROFINET option module. Power up the devices and test functionality.

Setting Fieldbus Connection Timeout Preferences

The VFD interface allows the user to set the “Communication Loss Timeout” and “Communication Loss Action” values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the range is from 0.0 (disable) to 5.0 seconds. Set these appropriately. A setting of 0.0 seconds will allow the VFD to continue running if communications is lost.

PROFINET Process Data Exchange Map

The typical mapping of VFD Process Data Output (PDO)/Process Data Input (PDI) to PROFINET Slave Addresses is shown below.

Process Data Word	Typical CPE Address
PDO1	%AI00001
PDO2	%AI00002
PDO3	%AI00003
PDO4	%AI00004
Additional Word 5	%AI00005
Additional Word 6	%AI00006
Additional Word 7	%AI00007
Additional Word 8	%AI00008
PDI1	%AQ00001
PDI2	%AQ00002
PDI3	%AQ00003
PDI4	%AQ00004

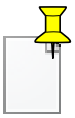
Supporting Files

Figure 42: VFD UDFB

VFD_CPE100_PN_UDFB.zip

Right-click the icon to Copy the file.

Figure 43: PROFINET UDFB to VFD Toolchest:



VFD_UDFBs.ZDRW

This Drawer also contains Modbus/TCP UDFB blocks)

Right-click the icon to Copy the file.

Figure 44: PROFINET UDFB to VFD XML Block Code

VFD_PNS.xml

Right-click the icon to Copy the file.

Other Modbus/TCP UDFBs

These UDFBs can be used similarly to the above UDFB. Nodes will change based on the function.

VFD_RD_PARM

Used to Read 1 Parameter from the VFD.

VFD_WR_PARM

Used to Write 1 Parameter to the VFD.

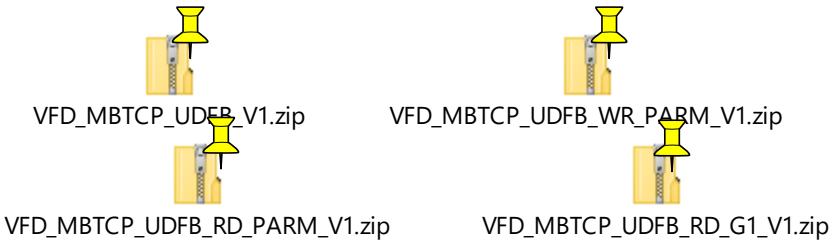
VFD_RD_G1

Used to Read all Group 1 Parameters from the VFD.

Supporting Files

Modbus/TCP UDFB to VFD PME Projects

Figure 45: VFD PME Projects with Modbus/TCP UDFB

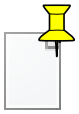


Right-click the icon to Copy the file.

Modbus/TCP UDFB to VFD Toolchest Drawer

(This Drawer also contains PROFINET UDFB blocks)

Figure 46:VFD Toolchest Drawer with Modbus/TCP UDFB



VFD_UDFBs.ZDRW

Right-click the icon to Copy the file.

Modbus/TCP UDFB to VFD XML Block Code

Figure 47: VFD XML Block Code for Modbus/TCP UDFBs

VFD_MBTCP.xml VFD_RD_PARM.xml VFD_WR_PARM.xml VFD_RD_G1.xml

Right-click the icon to Copy the file.

BLUETOOTH USB AND SERIAL CABLE (NOTE 7)

Communications to the VFD

Bluetooth BLE Connection

You can use the internal (built in) or external (USB) type Bluetooth BLE ports for your PC.

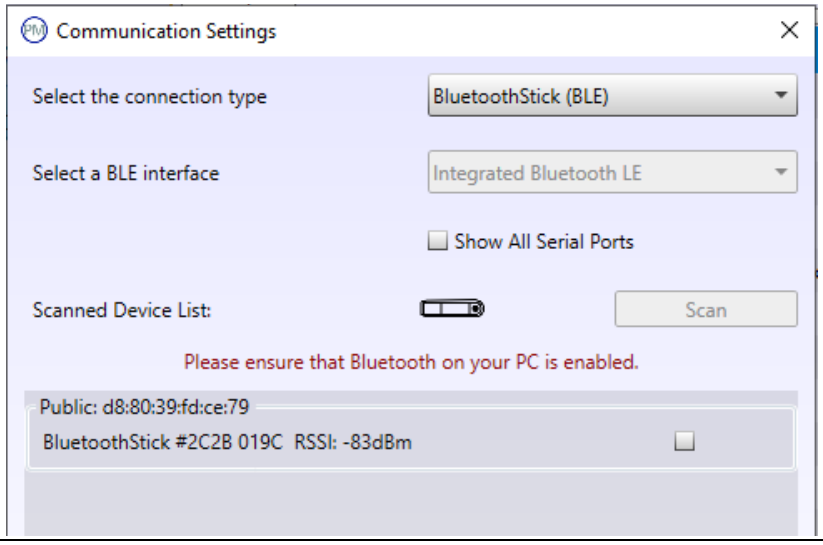
1. On the VFD plug the Bluetooth BLE USB Stick (typical part number IC866-BLUE) into the Serial port (not the RJ-45 LAN network port) and turn on power to the VFD.
   After a few seconds you should see the green, red, and blue LEDs similar to the picture below:

Figure 48: Bluetooth BLE USB Stick

2. Start the Emerson PACMotion VFD Studio program.
3. Go to Tools-Select Communications Device menu.
4. Select the connection type = BluetoothStick (BLE).

5. Select the BLE Interface = Integrated Bluetooth LE.
- This will be the typical built-in “Integrated Bluetooth LE” Bluetooth of your laptop.

Figure 49: Communication Settings



6. If you need to install an external Bluetooth device such as Bluetooth BLE USB Dongle be sure to use a “BLE” (Bluetooth Low Energy) device. A regular Bluetooth device will not work. One BLE tested device would be a BlueGiga part number BLED112-V1. When the driver for this USB device is installed it should be assigned to an available COM port and be selectable as seen below:

Figure 50: BLE Option

7. Click the Scan button.
   You should see the VFD "BluetoothStick" USB device in the list such as below:

Figure 51: VFD BlutoothStick Displayed in List

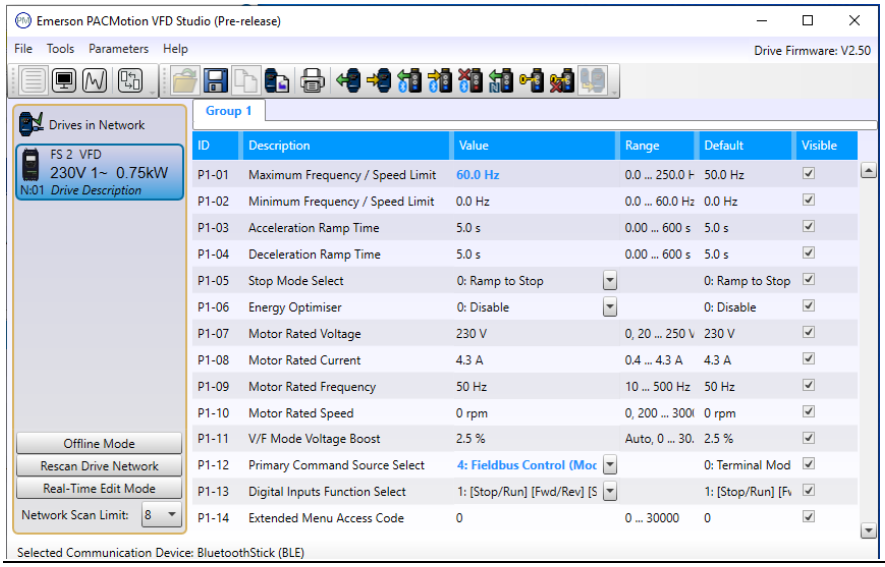
8. Click the small box to Select the VFD BluetoothStick device for connection.

9. Click the Connect button to connect to the Bluetooth Device.

10. Click the "Scan Drive Network" button (Allow a few seconds for the scan to complete).
    This should find the VFD and transfer parameters from the VFD to the Studio.

    In factory default mode you will only see Group 1 Tab with parameters (rows) for the VFD.

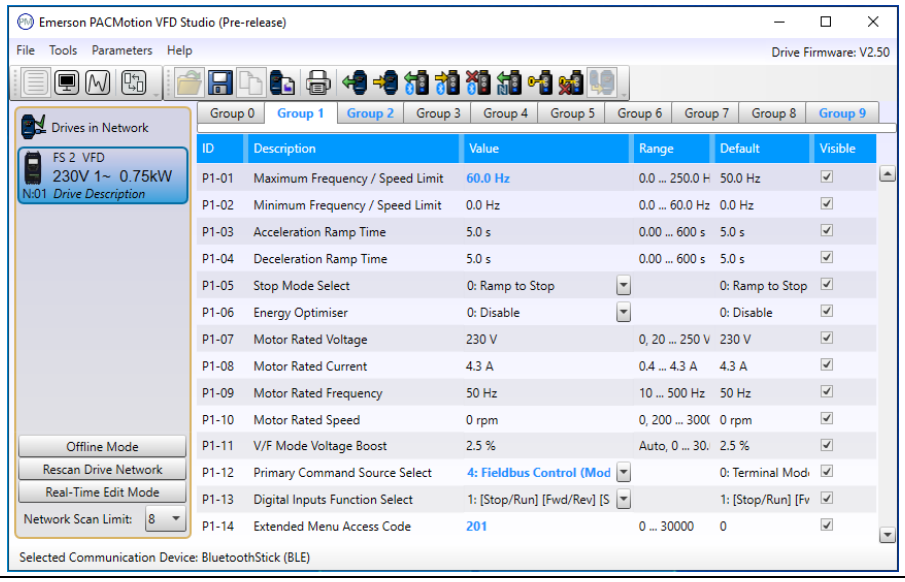
Figure 52: Group 1 Tab



11. Click on the variable number in the "Value" Column for P1-14 Extended Menu Access Code.

12. Change the value to 201 and then press enter to accept the value.
    You should see more Parameter tabs now (Group 0 to Group 9).

Figure 53: Parameter Tabs



13. Save these parameters to your PC for future use by clicking “File-Save Parameter Set As....”

14. Press and hold the Red Lock button on the USB for aprox 3 seconds (until the yellow LEDs stop flashing).
    This will unlock the USB.

    After a few seconds you should see the green, (no red), and blue LEDs similar to the picture below:

Figure 54: Bluetooth BLE LEDs

Notice on the USB the 2 Green arrows (R/W) appear and the Red Lock disappears.

15. Select Parameters-Transfer Parameter Set to Drive
    Allow a few seconds for the data to finish transferring from PC to VFD.
    On the VFD Display you will see: “Parameters Written Successfully” for a few seconds.
    This is how you would restore parameters in the VFD.

VFD Faceplate Parameter Access

16. Call up the VFD Parameter list with the VFD keypad.

    Press and hold the Navigate key > 2 seconds.

Figure 55: Navigate Key

You should see the parameters on the VFD faceplate display.
You can press the up and down Arrow Buttons to look at the various parameters.
Press the Navigate key once quickly to see the value of the parameter selected.

VFD Suite Real-Time Edit and Drive Monitor Tool

17. Click Real-Time Edit Mode button to enable Real-Time mode.

18. Scroll down to the Parameter P0-65 “Drive Life Time” row and select the box in the Refresh Column.
    You should see dynamic data updating in the Value Column.

19. Choose File-Save Parameter Set as your backup copy of the Real-Time parameters.

    To select the Drive Monitor Tool, you must briefly leave the Real-Time Edit mode.

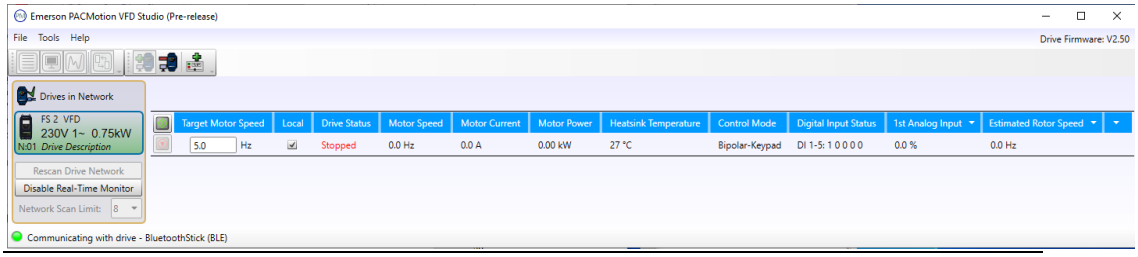
20. Click Disable Real-Time Edit.

21. Click Tools-Drive Monitor Tool.

22. Click the Enable Real-Time Monitor button.

23. In the “Local” column select the box for the VFD on your list.
    You should see Live data on the Monitor Screen.

Figure 56: Local Column



24. Start the Drive by pressing the green “Start The Motor” button (motor will RUN if permissives are true).

25. Enter a “Target Motor Speed” to Run the Drive.

26. Press the button again to Reverse the Motor.

27. Stop the Motor when finished.

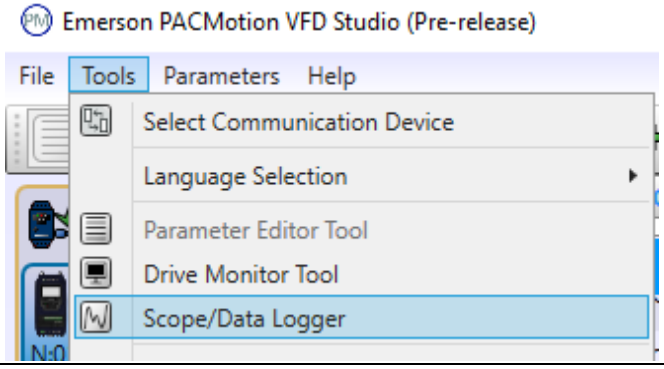
28. Disable the Real-Time Monitor when finished.

    VFD Real-Time Edit and Drive Monitor Tool

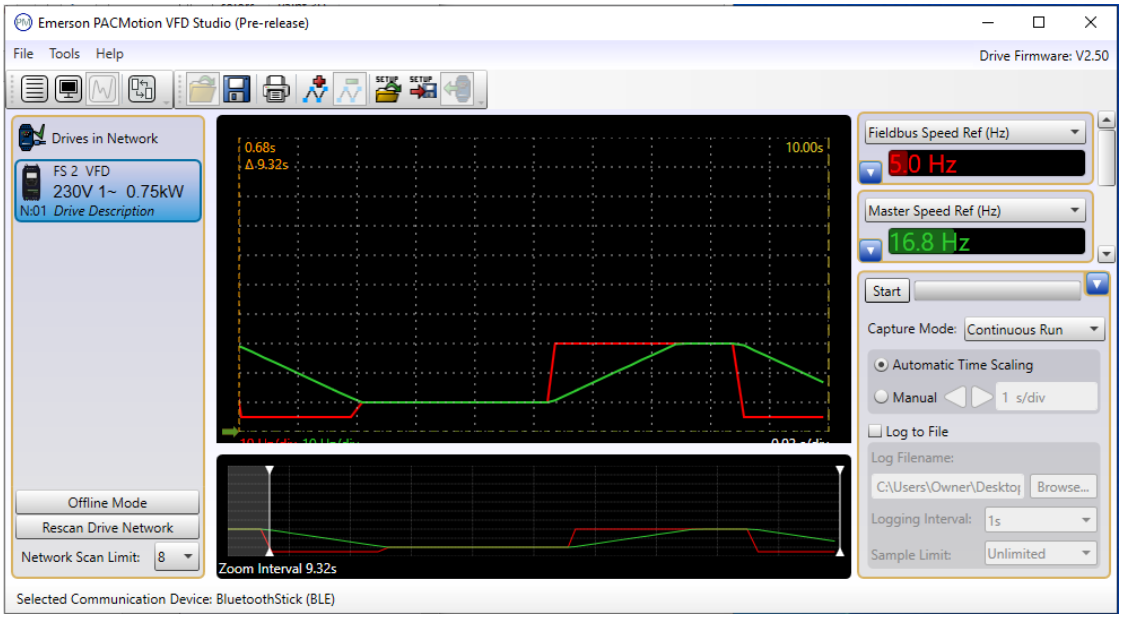
    To use the Scope and Data Logging Tool you must leave the Real-Time Edit mode.
29. Click Disable Real-Time Edit.

30. Click Tools-Scope/Data Logger

Figure 57: Scope/Data Logger



31. Choose the Channel 1 and 2 data similar to below and then Click the START Button to Capture Data.
    (Fieldbus Speed Ref (Hz) and Master Speed Ref (Hz))



32. Click the STOP Button to stop the capture.

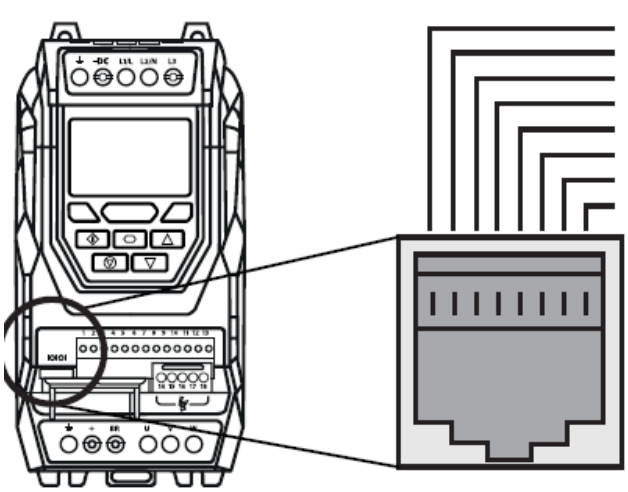
33. Choose File-Save Scope Data to keep the Captured information.
    This can also be saved as a CSV file type for analysis.

Serial RS-485 Communications to the VFD

1. Make sure your PC supports an open USB port and plug in the USB-to-Serial device (typical part number IC855-CABL-USB485).

   This is wired to connect to the Optibus pins (4 and 5) of the VFD serial.

Figure 58: USB-to-Serial Devices



1	CAN-
2	CAN+
3	0 Volts
4	Optibus / Remote Keypad / PC Connection
5	Optibus / Remote Keypad / PC Connection +
6	+24 Volt
7	-RS485 (Modbus RTU)
8	+RS485 (Modbus RTU)

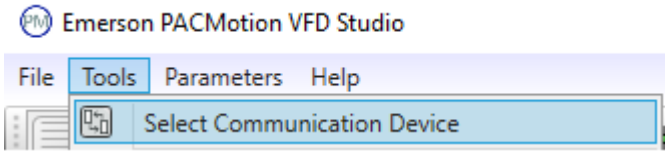
Warning:
This is not an Ethernet connection. Do not connect directly to an Ethernet port.

Warning:
When using Modbus RTU or CANopen, ensure that the 0V signal (T3) is also used to avoid comms errors and potentially damaging common mode voltages.

Your PC should recognize the USB device and assign a COM port.

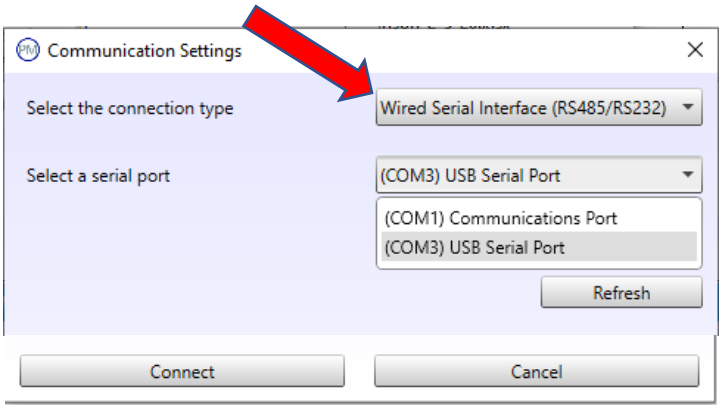
2. Click Tools – Select Communications Device.

Figure 59: Select Communication Device



3. Choose the “Wired Serial Interface (RS485/RS232)” and the appropriate COMx port number.

Figure 60: Connection Type



4. Click the “Connect” Button.

You should be able to Scan the Drive Network now and perform any of the functions in the above document as you did with the Bluetooth USB device.

Supporting Files

Figure 61: VFD Demo Case

VFD_S2_230V_0.75kW_V2.50_DemoCase

Right-click the icon to Copy the file.

PACMotion VFD Fieldbus Option Modules and Setup (NOTE 8)

MODBUS/TCP FIELDBUS OPTION MODULE

Option Module		
	IC866-OC-M	Modbus TCP Option Card for VFD

The Modbus/TCP option card permits the PACMotion Drive to connect to a Modbus/TCP network.

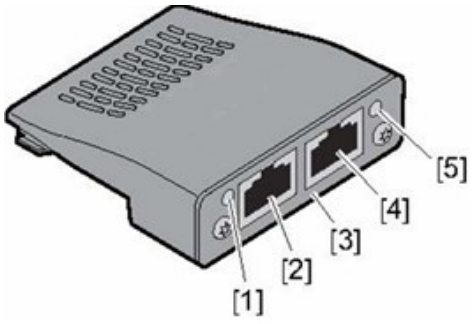


Figure 62: Modbus/TCP Option Card

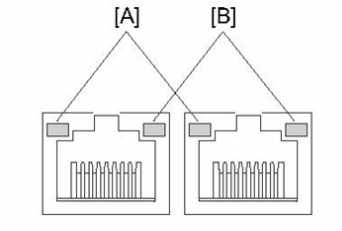


Figure 63: RJ45 Connectors & Network Activity LEDs, Modbus/TCP Option Card

[1]	LED: NS	[A]	LED: Activity
[2]	RJ45: P1	[B]	LED: Link
[3]	Labeling: Modbus/TCP		
[4]	RJ45: P2		
[5]	LED: MS		

Bus Specific Technical Data

Baud rate	10/100 Mbaud in full duplex mode
Connection technology	2 × RJ45

Hardware Insertion and Removal

Remove power from the VFD. Using a T09 driver bit, backout the option module 2 screws approximately 4 or 5 turns each. This should allow the locking tabs to retract to a flat position. Insert the module into the VFD fieldbus option module cage and gently press it into place. Secure the T09 screws until they touch the module. . This will engage the locking tabs to hold it in place. Do not over tighten .

Note: If the T09 screws are not backed out first the module will not insert/remove properly.

To remove the option module remove power from the VFD. Using a T09 driver bit backout the option module 2 screws approximately 4 or 5 turns each. Gently pull the module out by pulling on teh 2 screws.

IP Address Setup

The IP address of the Modbus/TCP module is set with a DHCP Server or with the IPCONFIGTOOL software from Anybus.

Start-Up and Operation

	Modbus/TCP
Parameter setting	*P1-12* = 4 (Fieldbus) *P1-14* = 101 (Extended parameter description)
IP address	The basic setting of the option card is the DHC protocol. To establish communication with the network, set the IP address using the "Anybus IPconfig" software. The freeware is available at www.anybus.com.
Bus structure	You can use the integrated Ethernet switch to achieve line topologies known from the fieldbus technology. Other bus topologies, such as star or tree, are also possible. Ring topologies are not supported.

LEDs

The Modbus/TCP option card has two LEDs, designated per Figure 62 as:

- NS for Network Status and
- MS for Module Status.

Network Status LED

Status	Explanation
Off	No supply voltage available.
Lights up green	Connection established, communication available.
Flashing green	Connection established, communication not available.
Lights up red	IP address is set to 0.0.0.0.
Flashing red	Communication timeout.

Module Status LED

Status	Explanation
Off	No supply voltage available.
Lights up green	Ethernet connection established, communication not available.
Lights up red	Option card fault.
Flashing red	IP conflict.

Modbus TCP Data Exchange

Modbus TCP process data is exchange utilizing the same format as described in section 9.1.1 Structure and Settings of Process Data Words. The mapping to Modbus TCP Registers is shown below.

Reference Word	Modbus TCP Register[4]
PO1	300001
PO2	300002
PO3	300003
PO4	300004
PI1	400001
PI2	400002
PI3	400003
PI4	400004

[4] Modbus Clients may address the first Modbus register as register 300001/400001. This assumes an address offset starting at 1. For Clients that use zero based addressing just subtract 1.

Modbus TCP Connection Timeout

The VFD Modbus TCP interface allows the user to set the "Communication Loss Timeout" and "Communication Loss Action" values. These parameters are at addresses P5-05 and P5-06 respectively. The Timeout units are 1 = 0.1 sec and the range is from 0.0 (disable) to 5.0 seconds.

Drive Parameter Access – Direct Address Method

The Modbus Interface allows the user to read/write directly the drive parameters. To perform this function, the user can directly access the parameter. Simply add the 3-digit parameter number to the Modbus offset of 400000.

For example:

Read parameter P1-01 (Maximum Frequency), perform the following

Read Modbus TCP Register 400101 value (scaling in 0.1 Hz).

Write parameter P1-01 (Maximum Frequency) = 60.0 Hz, perform the following

Write to Modbus TCP Register 400101 value = 600 (scaling in 0.1 Hz)

Drive Parameter Access – Indirect Address Method

The Modbus Interface allows the user to read/write indirectly the drive parameters. To do this you must use an Index number (Pointer) to point to the Parameter (Value) you want to access. The Index is at Modbus Address 404131. You must also use the next address 404132 to Read or Write the data desired.

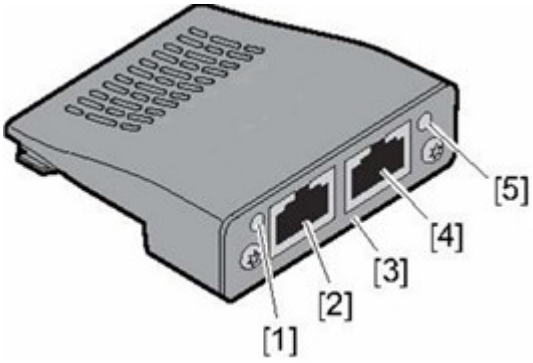
EXAMPLE: Given that the Index pointer = Addr. 404131 and Index Value = Addr. 404132
Read parameter P1-01 (Maximum Speed), perform the following:
Write to Modbus TCP Register 404131 a value = 101 <- Code for P1-01 (reference table)
*Read from Modbus TCP Register 404132 value = Parameter Value in P1-01
*P2-39 Lock/Unlock = will not affect this R/W of Parameters

To Write to P1-01 01 (Maximum Speed) and set it to 1800 rpm, perform the following:
Write to Modbus TCP Register 404131 value = 101 (This moves P1-01 current value into 404132)
**Write to Modbus TCP Register 404132 with the New value = 3600 (scaling in .5 rpm) eg. 6 = 0.1Hz
**P1-12 must be = 4 for Write capability into a Parameter. This could be done on the VFD faceplate or with the PACMotion VFD Suite.

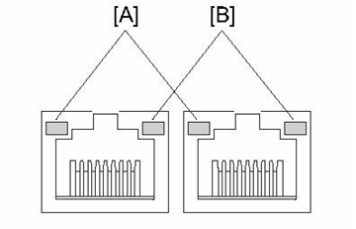
PROFINET FIELDBUS OPTION MODULE

Option Module Details: PROFINET Option Card for VFD Part Number: IC866-OC-P

The PROFINET option card permits the PACMotion VFD Drive to connect to a PROFINET network.



PROFINET Option Card



RJ45 Connectors & Network Activity LEDs, PROFINET Option Card

[1]	LED: NS	[A]	LED: Activity
[2]	RJ45: P1	[B]	LED: Link
[3]	Labeling: PROFINET I/O		
[4]	RJ45: P2		
[5]	LED: MS		

Bus Specific Technical Data

Baud rate	10/100 Mbaud in full duplex mode
Connection technology	2 × RJ45

Hardware Insertion and Removal

Remove power from the VFD. Using a T09 driver bit, backout the option module 2 screws approximately 4 or 5 turns each. This should allow the locking tabs to retract to a flat position. Insert the module into the VFD fieldbus option module cage and gently press it into place. Secure the T09 screws until they touch the module. This will engage the locking tabs to hold it in place. Do not over tighten.

Note: If the T09 screws are not backed out first the module will not insert/remove properly.

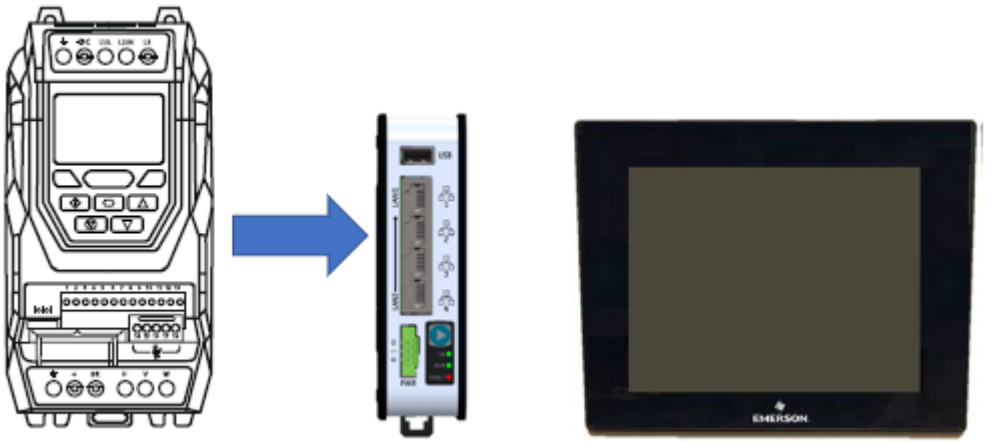
To remove the option module remove power from the VFD. Using a T09 driver bit backout the option module 2 screws approximately 4 or 5 turns each. Gently pull the module out.

PDO/PDI Data Map and Addressing (Note 9)

VFD Process Data Output (PDO1 - 4) From VFD to Client (Master)

The Client will initiate communications and READ this data from the VFD.

Figure 64: Modbus/TCP Client (Master)



Modbus/TCP PDO Data (or Built-in Modbus RTU Serial Port)

PDO1 (Drive Status Word - Fixed)

Modbus/TCP address: 300001

Bit 0	0 = Drive Disabled (Stopped), 1 = Drive Enabled (Running)
Bit 1	0 = Drive Healthy, 1 = Drive Tripped
Bit 2	No Function
Bit 3	0 = Drive Ready (STO Closed), 1 = Drive Inhibit (STO Open)
Bit 4	0 = Maintenance Time Not Reached, 1 = Maintenance Time Reached
Bit 5	0 = Not in Standby (Sleep), 1 = Standby (Sleep) mode Active
Bit 6	0 = Drive Not Ready, 1 = Drive Ready (Mains Power Applied, No Inhibit, No Trip, Enable Input Present)
Bit 7	No Function
Bits 8-15	Fault Number in the event of a Drive Trip

PDO2 (Output Frequency - Fixed)

Modbus/TCP address: 300002

123 = 12.3 Hz

PDO3 (Output Current or P5-12 select)

Modbus/TCP address: 300003

105 = 10.5 A

PDO4 (Output Torque or P5-08 select)

Modbus/TCP address: 300004

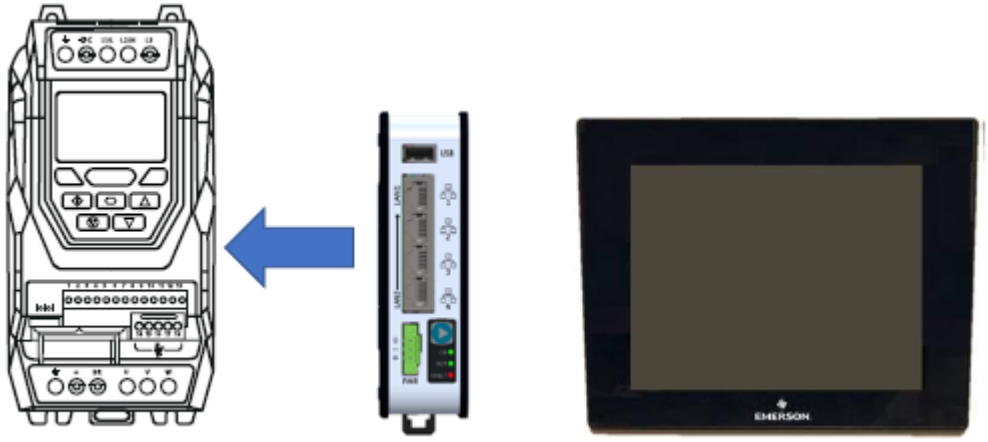
33 = 3.3 %

Modbus/TCP or RTU PDI Data

VFD Process Data Input (PDI1 - 4) From Client (Master) To Server (Slave)

The Client will initiate communications and WRITE this data to the VFD.

Figure 65: Modbus/TCP Client (Master)



PDI1 (Drive Control Word)

Modbus/TCP address: 400001

Bit 0	0 = Stop the Drive (Disable), 1 = Run the Drive (Enable)
Bit 1	0 = Allow Drive to Run, 1 = Enable Drive to Stop with 2nd deceleration ramp (Fast stop request.)
Bit 2	0 = No Fault Reset, 1 = reset any active faults or trips on the drive (Reset request). This bit must be reset to zero once the fault has been cleared.
Bit 3	0 = Allow Drive to Run. Set to 1 to issue a coast stop command (Coast stop request).
Bit 4-7	No Function

PDI2 (Frequency Reference)

Modbus/TCP address: 400002

500 = 50.0Hz

PDI3 (Torque Reference or P5-14 select)

Modbus/TCP address: 400003

1000 = 100.0%

PDI4 (Fieldbus Ramp or P5-13 to select, P5-07 to Enable)

Modbus/TCP address: 400004

60000 = 600.00s

PROFINET PDO Data

VFD Process Data Output (PDO1 - 4) From VFD to PROFINET Controller

The PROFINET Controller will RECEIVE this data from the VFD.

Figure 66: PROFINET PDO Data

PDO1 (Drive Status Word - Fixed)

PROFINET Slave assigned address: %AI00001 (Typical)

Bit 0	0 = Drive Disabled (Stopped), 1 = Drive Enabled (Running)
Bit 1	0 = Drive Healthy, 1 = Drive Tripped
Bit 2	No Function
Bit 3	0 = Drive Ready (STO Closed), 1 = Drive Inhibit (STO Open)
Bit 4	0 = Maintenance Time Not Reached, 1 = Maintenance Time Reached
Bit 5	0 = Not in Standby (Sleep), 1 = Standby (Sleep) mode Active
Bit 6	0 = Drive Not Ready, 1 = Drive Ready (Mains Power Applied, No Inhibit, No Trip, Enable Input Present)
Bit 7	No Function
Bits 8-15	Fault Number in the event of a Drive Trip

PDO2 (Output Frequency - Fixed)

PROFINET Slave assigned address: %AI00002 (Typical)

123 = 12.3 Hz

PDO3 (Output Current or P5-12 select)

PROFINET Slave assigned address: %AI00003 (Typical)

105 = 10.5 A

PDO4 (Output Torque or P5-08 select)

PROFINET Slave assigned address: %AI00004 (Typical)

33 = 3.3 %

VFD Data Output (PDO5 - 8) From VFD to PROFINET Controller – Additional to PDO

PROFINET Slave assigned address: WORD 5 = %AI00005 (Typical)

Bit 0	1 = Module OK (drive Healthy No Trip)
Bit 1	0 = Drive Healthy, 1 = Fault Present, Drive Tripped
Bit 2	0 = Port 1 Link Down, 1 = Port 1 Link Up
Bit 3	0 = Port 2 Link Down, 1 = Port 2 Link Up
Bit 4	Not Defined
Bit 5	Not Defined
Bit 6	Not Defined
Bit 7	Not Defined
Bit 8	0 = Mains Power Loss (“ML” indication), 1 = Mains power OK
Bit 9	1 = 24 V backup (external 24 V mode)
Bit 10	MRP enabled (fixed as 1)
Bit 11	MRP role (fixed as 0)
Bits 12-14	Not Defined
Bit 15	1 = Drive Ready to Run

PROFINET Slave assigned address: WORD 6 = %AI00006 (Typical)

Bit 0	0 = Drive Disabled (Stopped), 1 = Drive Enabled (Running)
Bit 1	0 = STO Open/OFF (Fault), 1 = STO Closed/ON (Good)
Bit 2	0 = No Service Due, 1 = Service Due

PROFINET Slave assigned address: WORD 7 = %AI00007 (Typical)

Not Defined

PROFINET Slave assigned address: WORD 8 = %AI00008 (Typical)

Not Defined

PROFINET PDI Data

VFD Process Data Input (PDI1 - 4) From PROFINET Controller to VFD

The PROFINET Controller will SEND this data to the VFD.

Figure 67: PROFINET PDI Data

PDI1 (Drive Control Word)

PROFINET Slave assigned address: %AQ00001 (Typical)

Bit 0	0 = Stop the Drive (Disable), 1 = Run the Drive (Enable)
Bit 1	0 = Allow Drive to Run, 1 = Enable Drive to Stop with 2nd deceleration ramp (Fast stop request.)
Bit 2	0 = No Fault Reset, 1 = reset any active faults or trips on the drive (Reset request). This bit must be reset to zero once the fault has been cleared.
Bit 3	0 = Allow Drive to Run. Set to 1 to issue a coast stop command (Coast stop request).
Bit 4-7	No Function

PDI2 (Frequency Reference)

PROFINET Slave assigned address: %AQ00002 (Typical)

500 = 50.0Hz

PDI3 (Torque Reference or P5-14 select)

PROFINET Slave assigned address: %AQ00003 (Typical)

1000 = 100.0%

PDI4 (Fieldbus Ramp or P5-13 to select, P5-07 to Enable)

PROFINET Slave assigned address: %AQ00004 (Typical)

60000 = 600.00s

PACMotion VFD Data Map and Addressing

(Note 10)

Complete Address Mapping Modbus/TCP, Modbus RTU, PROFINET

Figure 68: Excel Spreadsheets for all addresses

PACMotion_VFD_Address_Map.xlsx

Right-click the icon to Copy the file. Double-click to Open in Excel.

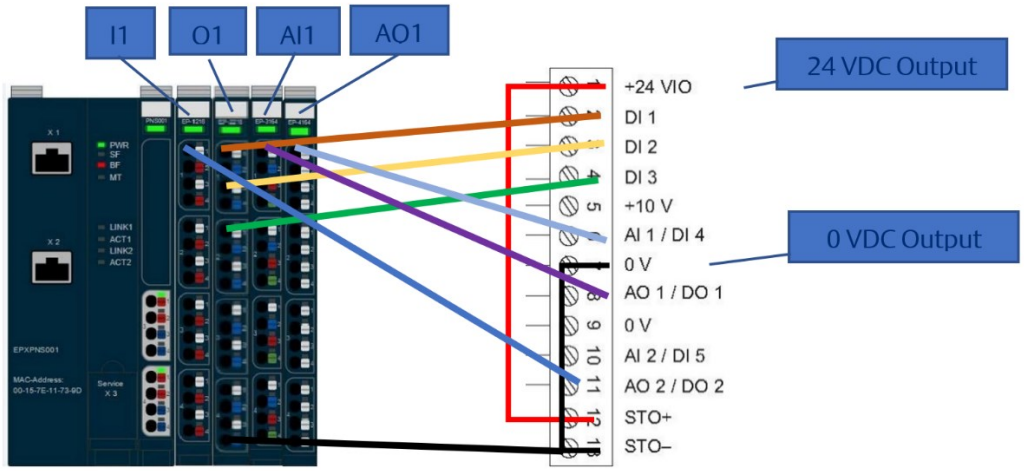
PACMotion VFD Demo Case Details (Note 11)

Quickpanel to CPE100 (Ethernet) and CPE100 to VFD (PROFINET)

Quickpanel to CPE100 (Ethernet) and CPE100 to VFD (PROFINET)

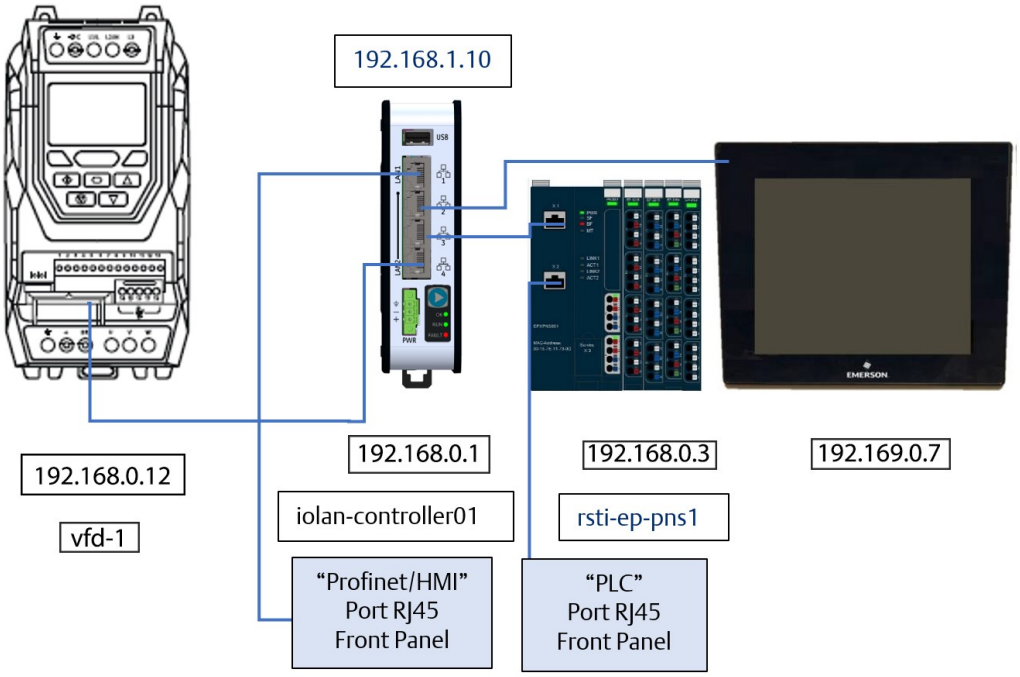
Signal Wiring, Interconnection and Addressing

Figure 69: Signal Wiring



Address	RSTi-EP I/O Module	To VFD Terminal Strip
%I00001	EP-1218	DI1 - Monitor Enabled State
%Q00001	EP-2218	DI1 - Enable
%Q00002	EP-2218	DI2 - Reverse
%Q00003	EP-2218	DI3 - Set Speed to SP1
%AI00001	EP-3164	AQ1 – Speed Feedback for Terminal Strip operation
%AQ00001	EP-4164	AI1 – Speed Reference for Terminal Strip operation

Figure 70: Interconnection and Addressing

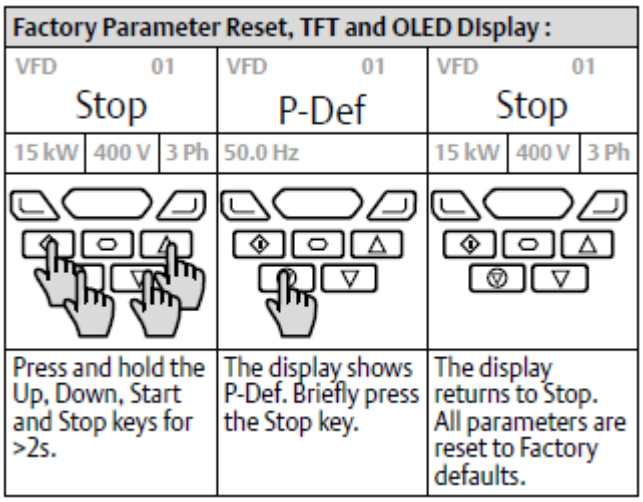


PACMotion VFD Demo Case and Factory Reset

Resetting the PACMotion VFD to Factory defaults

1. If necessary, you can reset the parameters VFD to factory defaults

Figure 71: Reset Parameters to Factory Defaults



Setting the following PACMotion VFD Parameters for PROFINET Demo Case Operation

2. Set the following Parameters for PROFINET Operation:

Parameter	Value	Definition
P1-14	201	Extended menu access (201=all parameters)
P4-02	1	Autotune (1=enable, VFD will set back to 0)
P1-07	230	Motor rated voltage (AC Volts)
P1-08	0.4	Motor rated current (Amps)
P1-09	60	Motor rated frequency (Hz)
P1-10	1600	Motor rated speed (RPM)
P1-12	4	Primary command source (4 = Fieldbus)
P2-13	0	AO2 Output 2 function (DO2 = 24VDC)

A file containing these settings can be found in Application Note 7.

They can be downloaded using the PACMotion VFD Studio. The file name is:

VFD_S2_230V_0.75kW_V2.50_DemoCase.ptl

General Contact Information

Home link: http://www.emerson.com/industrial-automation-controls

Knowledge Base: https://www.emerson.com/industrial-automation-controls/support

Technical Support

Americas
Phone: 1-888-565-4155
1-434-214-8532 (If toll free option is unavailable)

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Technical Support: support.mas.apac@emerson.com

Any escalation request should be sent to: mas.sfdcescalation@emerson.com

Note: If the product is purchased through an Authorized Channel Partner, please contact the seller directly for any support.

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